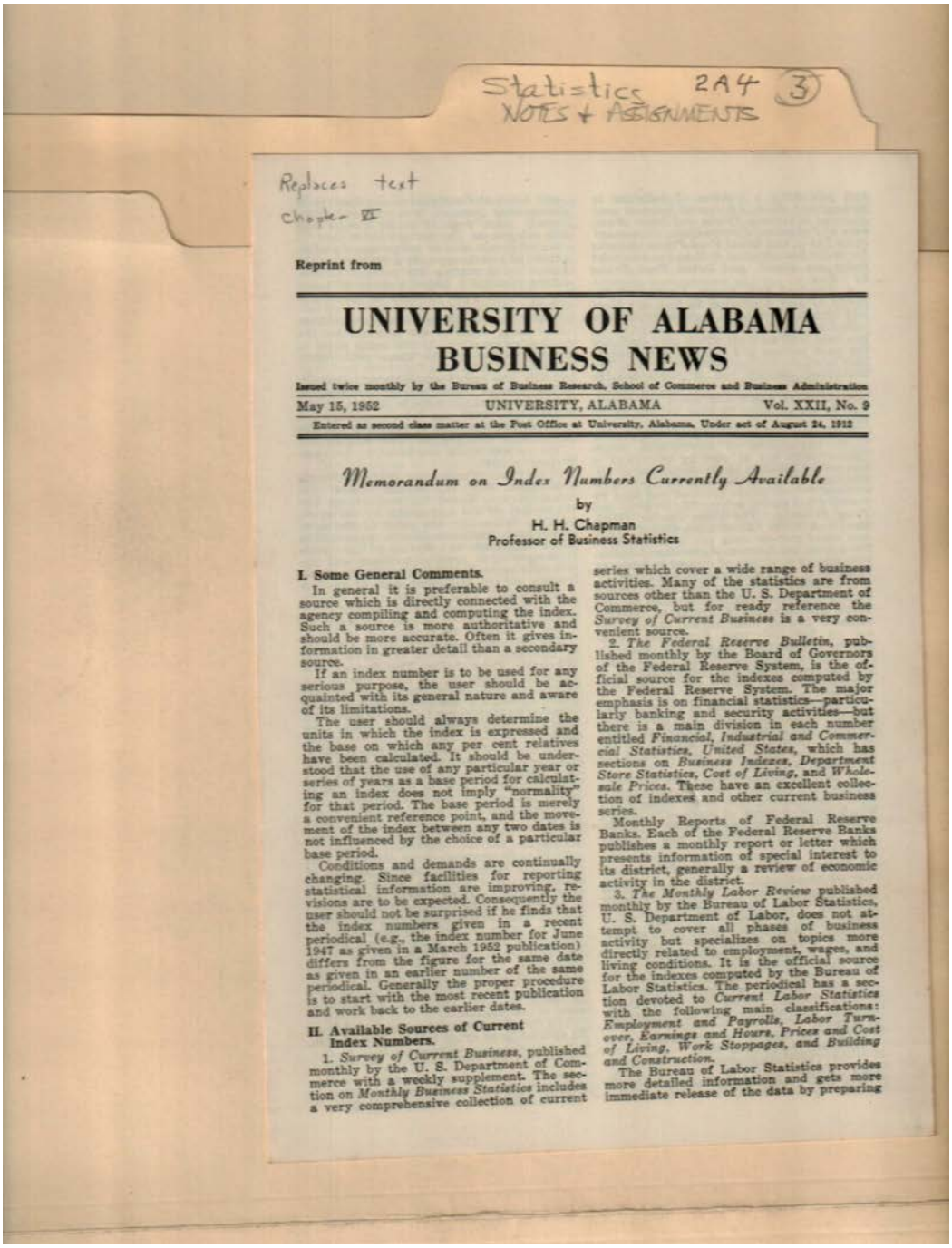

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Memorandum on Index Numbers Currently Available

by
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I. Some General Comments.

In general it is preferable to consult a source which is directly connected with the agency compiling and computing the index. Such a source is more authoritative and should be more accurate. Often it gives information in greater detail than a secondary source.

If an index number is to be used for any serious purpose, the user should be acquainted with its general nature and aware of its limitations.

The user should always determine the units in which the index is expressed and the base on which any per cent relatives have been calculated. It should be understood that the use of any particular year or series of years as a base period for calculating an index does not imply "normality" for that period. The base period is merely a convenient reference point, and the movement of the index between any two dates is not influenced by the choice of a particular base period.

Conditions and demands are continually changing. Since facilities for reporting statistical information are improving, revisions are to be expected. Consequently the user should not be surprised if he finds that the index numbers given in a recent periodical (e.g., the index number for June 1947 as given in a March 1952 publication) differs from the figure for the same date as given in an earlier number of the same periodical. Generally the proper procedure is to start with the most recent publication and work back to the earlier dates.

II. Available Sources of Current Index Numbers.

1. *Survey of Current Business*, published monthly by the U. S. Department of Commerce with a weekly supplement. The section on *Monthly Business Statistics* includes a very comprehensive collection of current series which cover a wide range of business activities. Many of the statistics are from sources other than the U. S. Department of Commerce, but for ready reference the *Survey of Current Business* is a very convenient source.

2. *The Federal Reserve Bulletin*, published monthly by the Board of Governors of the Federal Reserve System, is the official source for the indexes computed by the Federal Reserve System. The major emphasis is on financial statistics—particularly banking and security activities—but there is a main division in each number entitled *Financial, Industrial and Commercial Statistics, United States*, which has sections on *Business Indexes, Department Store Statistics, Cost of Living*, and *Wholesale Prices*. These have an excellent collection of indexes and other current business series.

Monthly Reports of Federal Reserve Banks. Each of the Federal Reserve Banks publishes a monthly report or letter which presents information of special interest to its district, generally a review of economic activity in the district.

3. *The Monthly Labor Review* published monthly by the Bureau of Labor Statistics, U. S. Department of Labor, does not attempt to cover all phases of business activity but specializes on topics more directly related to employment, wages, and living conditions. It is the official source for the indexes computed by the Bureau of Labor Statistics. The periodical has a section devoted to *Current Labor Statistics* with the following main classifications: *Employment and Payrolls, Labor Turnover, Earnings and Hours, Prices and Cost of Living, Work Stoppages, and Building and Construction.*

The Bureau of Labor Statistics provides more detailed information and gets more immediate release of the data by preparing

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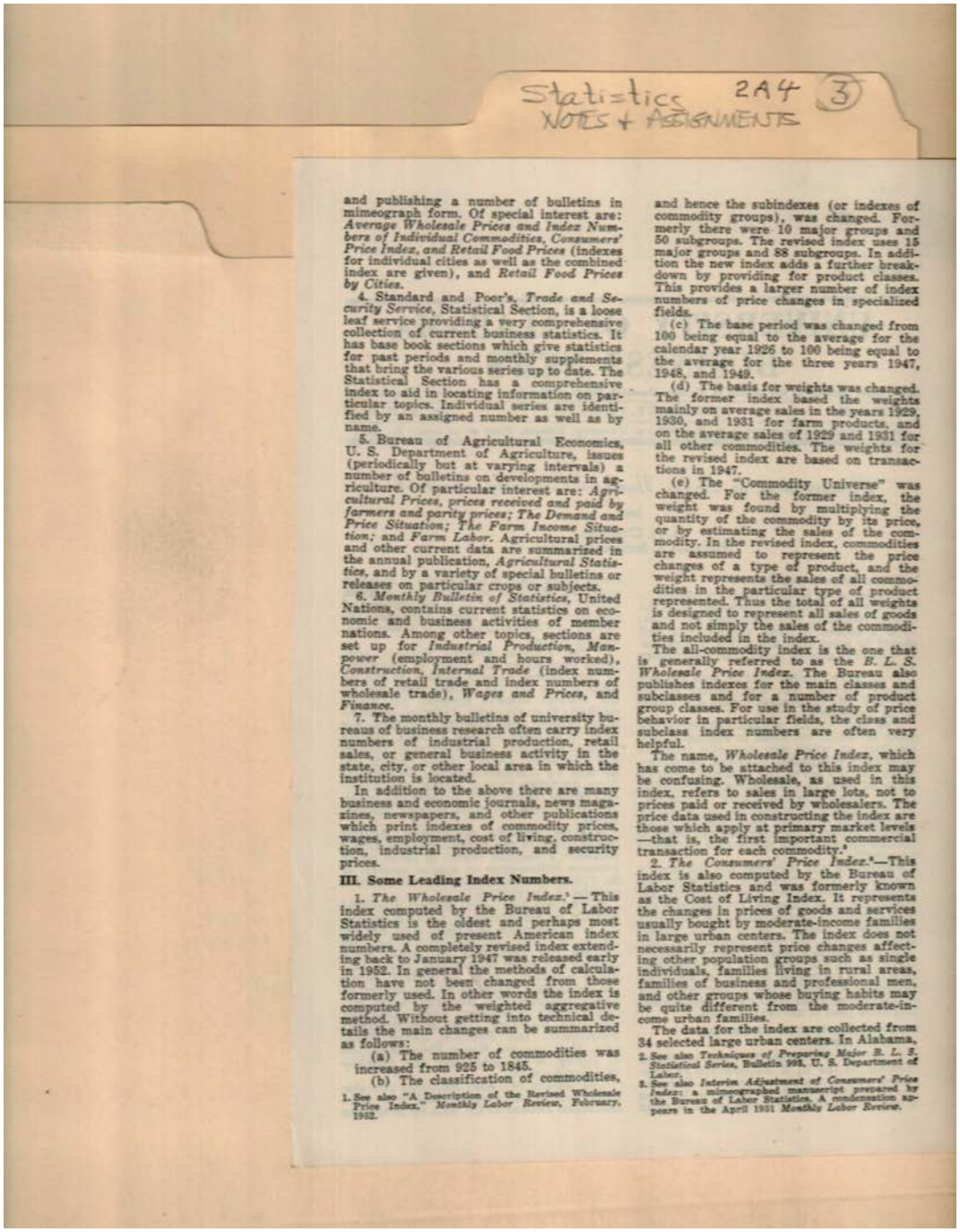

and publishing a number of bulletins in mimeograph form. Of special interest are: *Average Wholesale Prices and Index Numbers of Individual Commodities, Consumers' Price Index, and Retail Food Prices* (indexes for individual cities as well as the combined index are given), and *Retail Food Prices by Cities.*

4. Standard and Poor's, *Trade and Security Service*, Statistical Section, is a loose leaf service providing a very comprehensive collection of current business statistics. It has base book sections which give statistics for past periods and monthly supplements that bring the various series up to date. The Statistical Section has a comprehensive index to aid in locating information on particular topics. Individual series are identified by an assigned number as well as by name.

5. Bureau of Agricultural Economics, U. S. Department of Agriculture, issues (periodically but at varying intervals) a number of bulletins on developments in agriculture. Of particular interest are: *Agricultural Prices, prices received and paid by farmers and parity prices; The Demand and Price Situation; The Farm Income Situation;* and *Farm Labor.* Agricultural prices and other current data are summarized in the annual publication, *Agricultural Statistics*, and by a variety of special bulletins or releases on particular crops or subjects.

6. *Monthly Bulletin of Statistics*, United Nations, contains current statistics on economic and business activities of member nations. Among other topics, sections are set up for *Industrial Production, Manpower* (employment and hours worked), *Construction, Internal Trade* (index numbers of retail trade and index numbers of wholesale trade), *Wages and Prices*, and *Finance.*

7. The monthly bulletins of university bureaus of business research often carry index numbers of industrial production, retail sales, or general business activity in the state, city, or other local area in which the institution is located.

In addition to the above there are many business and economic journals, news magazines, newspapers, and other publications which print indexes of commodity prices, wages, employment, cost of living, construction, industrial production, and security prices.

III. Some Leading Index Numbers.

1. *The Wholesale Price Index.*[1] — This index computed by the Bureau of Labor Statistics is the oldest and perhaps most widely used of present American index numbers. A completely revised index extending back to January 1947 was released early in 1952. In general the methods of calculation have not been changed from those formerly used. In other words the index is computed by the weighted aggregative method. Without getting into technical details the main changes can be summarized as follows:

(a) The number of commodities was increased from 925 to 1845.

(b) The classification of commodities, and hence the subindexes (or indexes of commodity groups), was changed. Formerly there were 10 major groups and 50 subgroups. The revised index uses 15 major groups and 88 subgroups. In addition the new index adds a further breakdown by providing for product classes. This provides a larger number of index numbers of price changes in specialized fields.

(c) The base period was changed from 100 being equal to the average for the calendar year 1926 to 100 being equal to the average for the three years 1947, 1948, and 1949.

(d) The basis for weights was changed. The former index based the weights mainly on average sales in the years 1929, 1930, and 1931 for farm products, and on the average sales of 1929 and 1931 for all other commodities. The weights for the revised index are based on transactions in 1947.

(e) The "Commodity Universe" was changed. For the former index, the weight was found by multiplying the quantity of the commodity by its price, or by estimating the sales of the commodity. In the revised index, commodities are assumed to represent the price changes of a type of product, and the weight represents the sales of all commodities in the particular type of product represented. Thus the total of all weights is designed to represent all sales of goods and not simply the sales of the commodities included in the index.

The all-commodity index is the one that is generally referred to as the *B. L. S. Wholesale Price Index.* The Bureau also publishes indexes for the main classes and subclasses and for a number of product group classes. For use in the study of price behavior in particular fields, the class and subclass index numbers are often very helpful.

The name, *Wholesale Price Index*, which has come to be attached to this index may be confusing. Wholesale, as used in this index, refers to sales in large lots, not to prices paid or received by wholesalers. The price data used in constructing the index are those which apply at primary market levels —that is, the first important commercial transaction for each commodity.[2]

2. *The Consumers' Price Index.*[3]—This index is also computed by the Bureau of Labor Statistics and was formerly known as the Cost of Living Index. It represents the changes in prices of goods and services usually bought by moderate-income families in large urban centers. The index does not necessarily represent price changes affecting other population groups such as single individuals, families living in rural areas, families of business and professional men, and other groups whose buying habits may be quite different from the moderate-income urban families.

The data for the index are collected from 34 selected large urban centers. In Alabama,

1. See also "A Description of the Revised Wholesale Price Index," *Monthly Labor Review*, February, 1952.

2. See also *Techniques of Preparing Major B. L. S. Statistical Series*, Bulletin 998, U. S. Department of Labor.

3. See also *Interim Adjustment of Consumers' Price Index*: a mimeographed manuscript prepared by the Bureau of Labor Statistics. A condensation appears in the April 1951 *Monthly Labor Review.*

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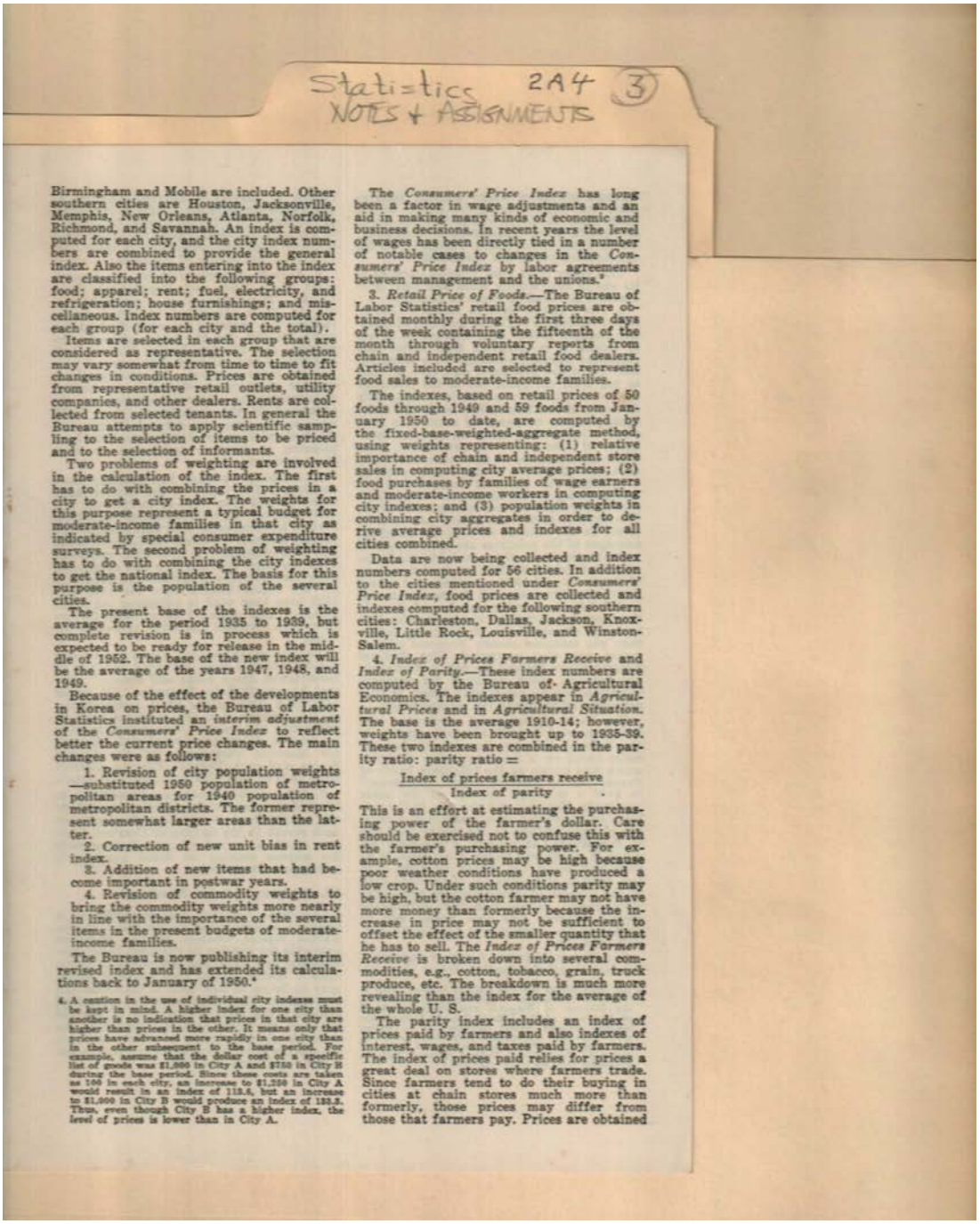

Birmingham and Mobile are included. Other southern cities are Houston, Jacksonville, Memphis, New Orleans, Atlanta, Norfolk, Richmond, and Savannah. An index is computed for each city, and the city index numbers are combined to provide the general index. Also the items entering into the index are classified into the following groups: food; apparel; rent; fuel, electricity, and refrigeration; house furnishings; and miscellaneous. Index numbers are computed for each group (for each city and the total).

Items are selected in each group that are considered as representative. The selection may vary somewhat from time to time to fit changes in conditions. Prices are obtained from representative retail outlets, utility companies, and other dealers. Rents are collected from selected tenants. In general the Bureau attempts to apply scientific sampling to the selection of items to be priced and to the selection of informants.

Two problems of weighting are involved in the calculation of the index. The first has to do with combining the prices in a city to get a city index. The weights for this purpose represent a typical budget for moderate-income families in that city as indicated by special consumer expenditure surveys. The second problem of weighting has to do with combining the city indexes to get the national index. The basis for this purpose is the population of the several cities.

The present base of the indexes is the average for the period 1935 to 1939, but complete revision is in process which is expected to be ready for release in the middle of 1952. The base of the new index will be the average of the years 1947, 1948, and 1949.

Because of the effect of the developments in Korea on prices, the Bureau of Labor Statistics instituted an *interim adjustment* of the *Consumers' Price Index* to reflect better the current price changes. The main changes were as follows:

1. Revision of city population weights —substituted 1950 population of metropolitan areas for 1940 population of metropolitan districts. The former represent somewhat larger areas than the latter.
2. Correction of new unit bias in rent index.
3. Addition of new items that had become important in postwar years.
4. Revision of commodity weights to bring the commodity weights more nearly in line with the importance of the several items in the present budgets of moderate-income families.

The Bureau is now publishing its interim revised index and has extended its calculations back to January of 1950.*

4. A caution in the use of individual city indexes must be kept in mind. A higher index for one city than another is no indication that prices in that city are higher than prices in the other. It means only that prices have advanced more rapidly in one city than in the other subsequent to the base period. For example, assume that the dollar cost of a specific list of goods was $1,000 in City A and $750 in City B during the base period. Since these costs are taken as 100 in each city, an increase to $1,250 in City A would result in an index of 125.0, but an increase to $1,000 in City B would produce an index of 133.3. Thus, even though City B has a higher index, the *level* of prices is lower than in City A.

The *Consumers' Price Index* has long been a factor in wage adjustments and an aid in making many kinds of economic and business decisions. In recent years the level of wages has been directly tied in a number of notable cases to changes in the *Consumers' Price Index* by labor agreements between management and the unions.*

3. *Retail Price of Foods.*—The Bureau of Labor Statistics' retail food prices are obtained monthly during the first three days of the week containing the fifteenth of the month through voluntary reports from chain and independent retail food dealers. Articles included are selected to represent food sales to moderate-income families.

The indexes, based on retail prices of 50 foods through 1949 and 59 foods from January 1950 to date, are computed by the fixed-base-weighted-aggregate method, using weights representing: (1) relative importance of chain and independent store sales in computing city average prices; (2) food purchases by families of wage earners and moderate-income workers in computing city indexes; and (3) population weights in combining city aggregates in order to derive average prices and indexes for all cities combined.

Data are now being collected and index numbers computed for 56 cities. In addition to the cities mentioned under *Consumers' Price Index*, food prices are collected and indexes computed for the following southern cities: Charleston, Dallas, Jackson, Knoxville, Little Rock, Louisville, and Winston-Salem.

4. *Index of Prices Farmers Receive* and *Index of Parity.*—These index numbers are computed by the Bureau of Agricultural Economics. The indexes appear in *Agricultural Prices* and in *Agricultural Situation.* The base is the average 1910-14; however, weights have been brought up to 1935-39. These two indexes are combined in the parity ratio: parity ratio =

$$\frac{\text{Index of prices farmers receive}}{\text{Index of parity}}$$

This is an effort at estimating the purchasing power of the farmer's dollar. Care should be exercised not to confuse this with the farmer's purchasing power. For example, cotton prices may be high because poor weather conditions have produced a low crop. Under such conditions parity may be high, but the cotton farmer may not have more money than formerly because the increase in price may not be sufficient to offset the effect of the smaller quantity that he has to sell. The *Index of Prices Farmers Receive* is broken down into several commodities, e.g., cotton, tobacco, grain, truck produce, etc. The breakdown is much more revealing than the index for the average of the whole U. S.

The parity index includes an index of prices paid by farmers and also indexes of interest, wages, and taxes paid by farmers. The index of prices paid relies for prices a great deal on stores where farmers trade. Since farmers tend to do their buying in cities at chain stores much more than formerly, those prices may differ from those that farmers pay. Prices are obtained

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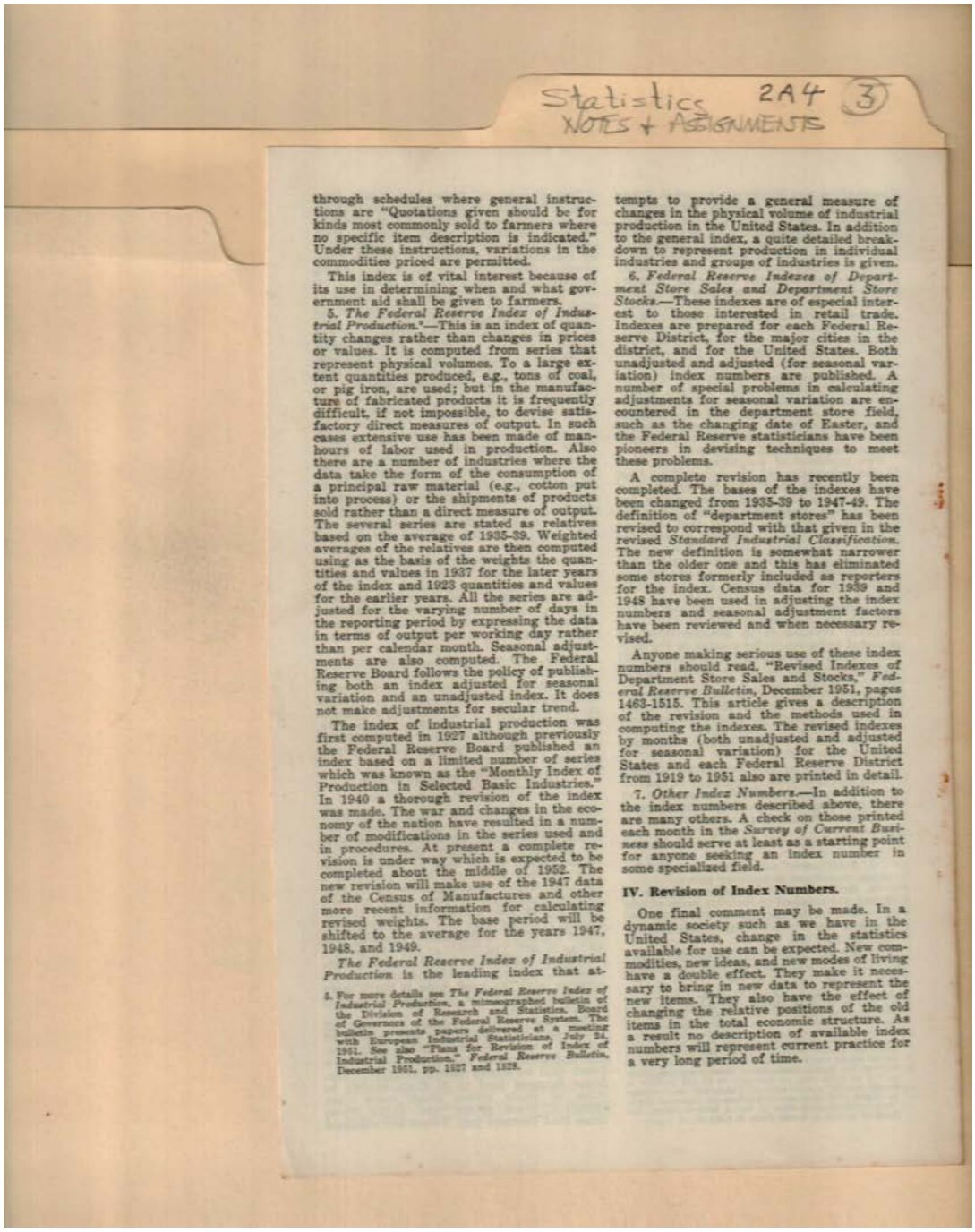

through schedules where general instructions are "Quotations given should be for kinds most commonly sold to farmers where no specific item description is indicated." Under these instructions, variations in the commodities priced are permitted.

This index is of vital interest because of its use in determining when and what government aid shall be given to farmers.

5. *The Federal Reserve Index of Industrial Production.*[4]—This is an index of quantity changes rather than changes in prices or values. It is computed from series that represent physical volumes. To a large extent quantities produced, e.g., tons of coal, or pig iron, are used; but in the manufacture of fabricated products it is frequently difficult, if not impossible, to devise satisfactory direct measures of output. In such cases extensive use has been made of man-hours of labor used in production. Also there are a number of industries where the data take the form of the consumption of a principal raw material (e.g., cotton put into process) or the shipments of products sold rather than a direct measure of output. The several series are stated as relatives based on the average of 1935-39. Weighted averages of the relatives are then computed using as the basis of the weights the quantities and values in 1937 for the later years of the index and 1923 quantities and values for the earlier years. All the series are adjusted for the varying number of days in the reporting period by expressing the data in terms of output per working day rather than per calendar month. Seasonal adjustments are also computed. The Federal Reserve Board follows the policy of publishing both an index adjusted for seasonal variation and an unadjusted index. It does not make adjustments for secular trend.

The index of industrial production was first computed in 1927 although previously the Federal Reserve Board published an index based on a limited number of series which was known as the "Monthly Index of Production in Selected Basic Industries." In 1940 a thorough revision of the index was made. The war and changes in the economy of the nation have resulted in a number of modifications in the series used and in procedures. At present a complete revision is under way which is expected to be completed about the middle of 1952. The new revision will make use of the 1947 data of the Census of Manufactures and other more recent information for calculating revised weights. The base period will be shifted to the average for the years 1947, 1948, and 1949.

The Federal Reserve Index of Industrial Production is the leading index that attempts to provide a general measure of changes in the physical volume of industrial production in the United States. In addition to the general index, a quite detailed breakdown to represent production in individual industries and groups of industries is given.

6. *Federal Reserve Indexes of Department Store Sales and Department Store Stocks.*—These indexes are of especial interest to those interested in retail trade. Indexes are prepared for each Federal Reserve District, for the major cities in the district, and for the United States. Both unadjusted and adjusted (for seasonal variation) index numbers are published. A number of special problems in calculating adjustments for seasonal variation are encountered in the department store field, such as the changing date of Easter, and the Federal Reserve statisticians have been pioneers in devising techniques to meet these problems.

A complete revision has recently been completed. The bases of the indexes have been changed from 1935-39 to 1947-49. The definition of "department stores" has been revised to correspond with that given in the revised *Standard Industrial Classification.* The new definition is somewhat narrower than the older one and this has eliminated some stores formerly included as reporters for the index. Census data for 1939 and 1948 have been used in adjusting the index numbers and seasonal adjustment factors have been reviewed and when necessary revised.

Anyone making serious use of these index numbers should read, "Revised Indexes of Department Store Sales and Stocks," *Federal Reserve Bulletin*, December 1951, pages 1463-1515. This article gives a description of the revision and the methods used in computing the indexes. The revised indexes by months (both unadjusted and adjusted for seasonal variation) for the United States and each Federal Reserve District from 1919 to 1951 also are printed in detail.

7. *Other Index Numbers.*—In addition to the index numbers described above, there are many others. A check on those printed each month in the *Survey of Current Business* should serve at least as a starting point for anyone seeking an index number in some specialized field.

IV. Revision of Index Numbers.

One final comment may be made. In a dynamic society such as we have in the United States, change in the statistics available for use can be expected. New commodities, new ideas, and new modes of living have a double effect. They make it necessary to bring in new data to represent the new items. They also have the effect of changing the relative positions of the old items in the total economic structure. As a result no description of available index numbers will represent current practice for a very long period of time.

4. For more details see *The Federal Reserve Index of Industrial Production*, a mimeographed bulletin of the Division of Research and Statistics, Board of Governors of the Federal Reserve System. The bulletin presents papers delivered at a meeting with European Industrial Statisticians, July 24, 1951. See also "Plans for Revision of Index of Industrial Production," *Federal Reserve Bulletin*, December 1951, pp. 1327 and 1329.

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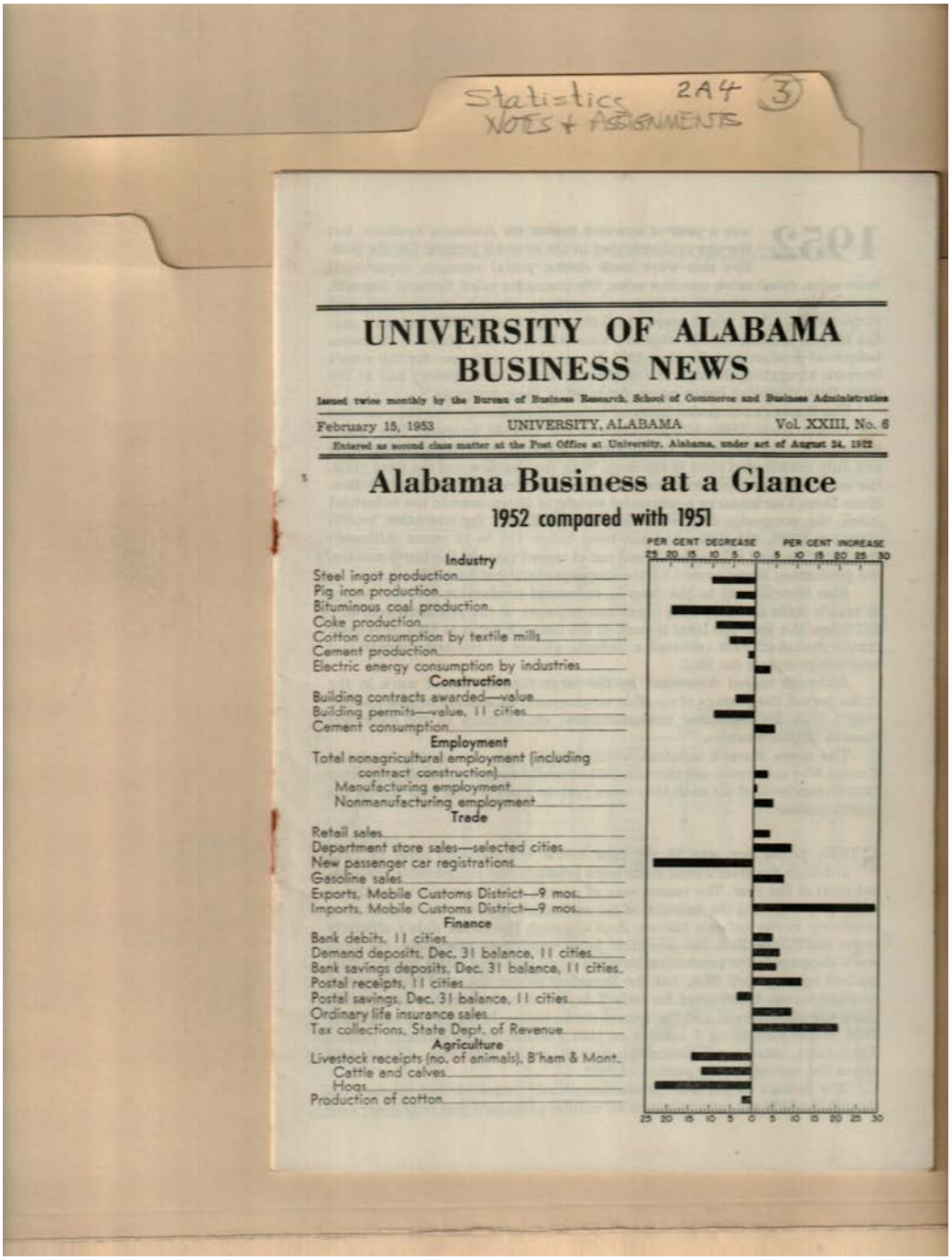

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Alabama Business at a Glance

1952 compared with 1951

PER CENT DECREASE 25 20 15 10 5 0 — PER CENT INCREASE 0 5 10 15 20 25 30

Industry
Steel ingot production
Pig iron production
Bituminous coal production
Coke production
Cotton consumption by textile mills
Cement production
Electric energy consumption by industries

Construction
Building contracts awarded—value
Building permits—value, 11 cities
Cement consumption

Employment
Total nonagricultural employment (including contract construction)
Manufacturing employment
Nonmanufacturing employment

Trade
Retail sales
Department store sales—selected cities
New passenger car registrations
Gasoline sales
Exports, Mobile Customs District—9 mos.
Imports, Mobile Customs District—9 mos.

Finance
Bank debits, 11 cities
Demand deposits, Dec. 31 balance, 11 cities
Bank savings deposits, Dec. 31 balance, 11 cities
Postal receipts, 11 cities
Postal savings, Dec. 31 balance, 11 cities
Ordinary life insurance sales
Tax collections, State Dept. of Revenue

Agriculture
Livestock receipts (no. of animals), B'ham & Mont.
Cattle and calves
Hogs
Production of cotton

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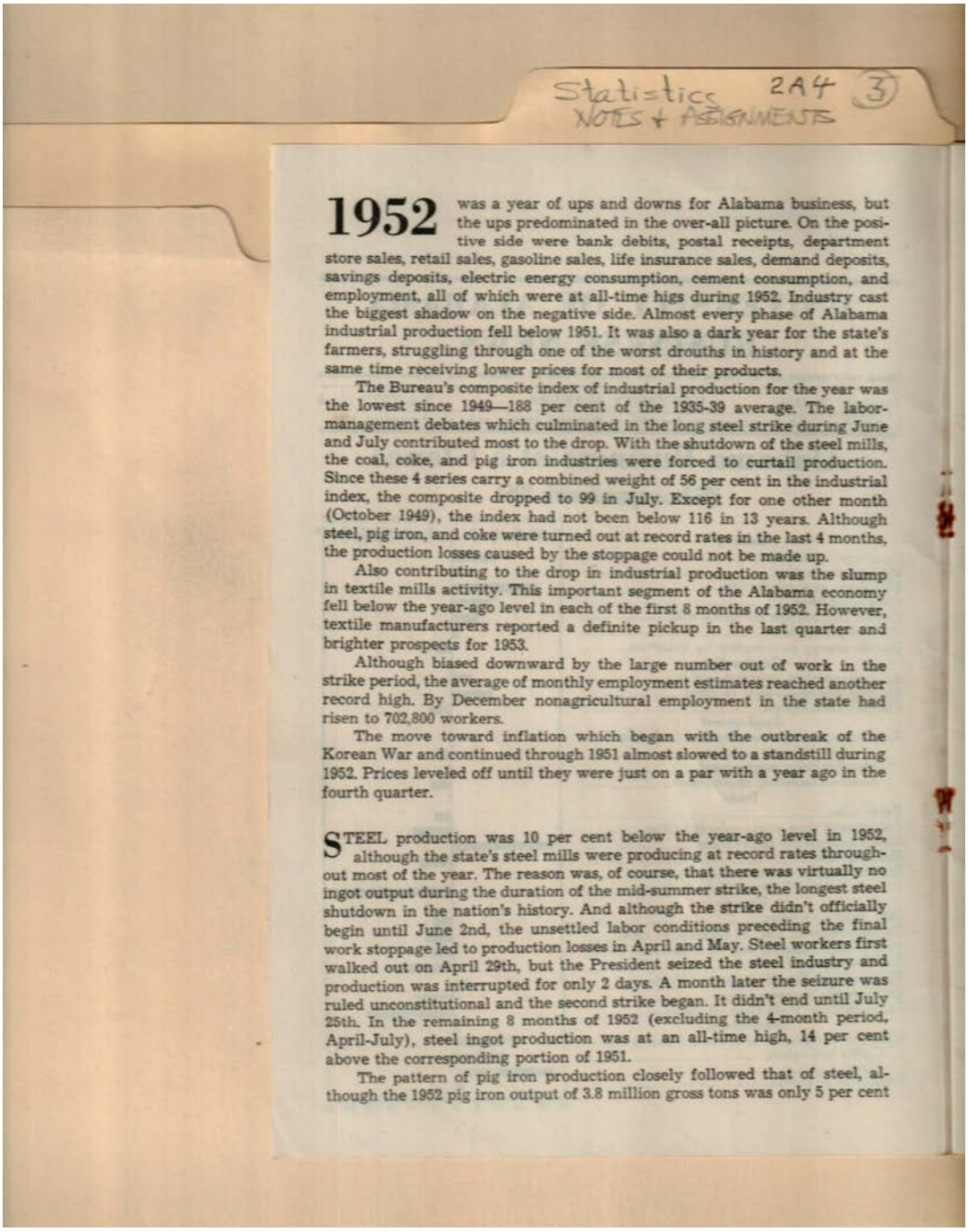

1952 was a year of ups and downs for Alabama business, but the ups predominated in the over-all picture. On the positive side were bank debits, postal receipts, department store sales, retail sales, gasoline sales, life insurance sales, demand deposits, savings deposits, electric energy consumption, cement consumption, and employment, all of which were at all-time higs during 1952. Industry cast the biggest shadow on the negative side. Almost every phase of Alabama industrial production fell below 1951. It was also a dark year for the state's farmers, struggling through one of the worst drouths in history and at the same time receiving lower prices for most of their products.

The Bureau's composite index of industrial production for the year was the lowest since 1949—188 per cent of the 1935-39 average. The labor-management debates which culminated in the long steel strike during June and July contributed most to the drop. With the shutdown of the steel mills, the coal, coke, and pig iron industries were forced to curtail production. Since these 4 series carry a combined weight of 56 per cent in the industrial index, the composite dropped to 99 in July. Except for one other month (October 1949), the index had not been below 116 in 13 years. Although steel, pig iron, and coke were turned out at record rates in the last 4 months, the production losses caused by the stoppage could not be made up.

Also contributing to the drop in industrial production was the slump in textile mills activity. This important segment of the Alabama economy fell below the year-ago level in each of the first 8 months of 1952. However, textile manufacturers reported a definite pickup in the last quarter and brighter prospects for 1953.

Although biased downward by the large number out of work in the strike period, the average of monthly employment estimates reached another record high. By December nonagricultural employment in the state had risen to 702,800 workers.

The move toward inflation which began with the outbreak of the Korean War and continued through 1951 almost slowed to a standstill during 1952. Prices leveled off until they were just on a par with a year ago in the fourth quarter.

STEEL production was 10 per cent below the year-ago level in 1952, although the state's steel mills were producing at record rates throughout most of the year. The reason was, of course, that there was virtually no ingot output during the duration of the mid-summer strike, the longest steel shutdown in the nation's history. And although the strike didn't officially begin until June 2nd, the unsettled labor conditions preceding the final work stoppage led to production losses in April and May. Steel workers first walked out on April 29th, but the President seized the steel industry and production was interrupted for only 2 days. A month later the seizure was ruled unconstitutional and the second strike began. It didn't end until July 25th. In the remaining 8 months of 1952 (excluding the 4-month period, April-July), steel ingot production was at an all-time high, 14 per cent above the corresponding portion of 1951.

The pattern of pig iron production closely followed that of steel, although the 1952 pig iron output of 3.8 million gross tons was only 5 per cent

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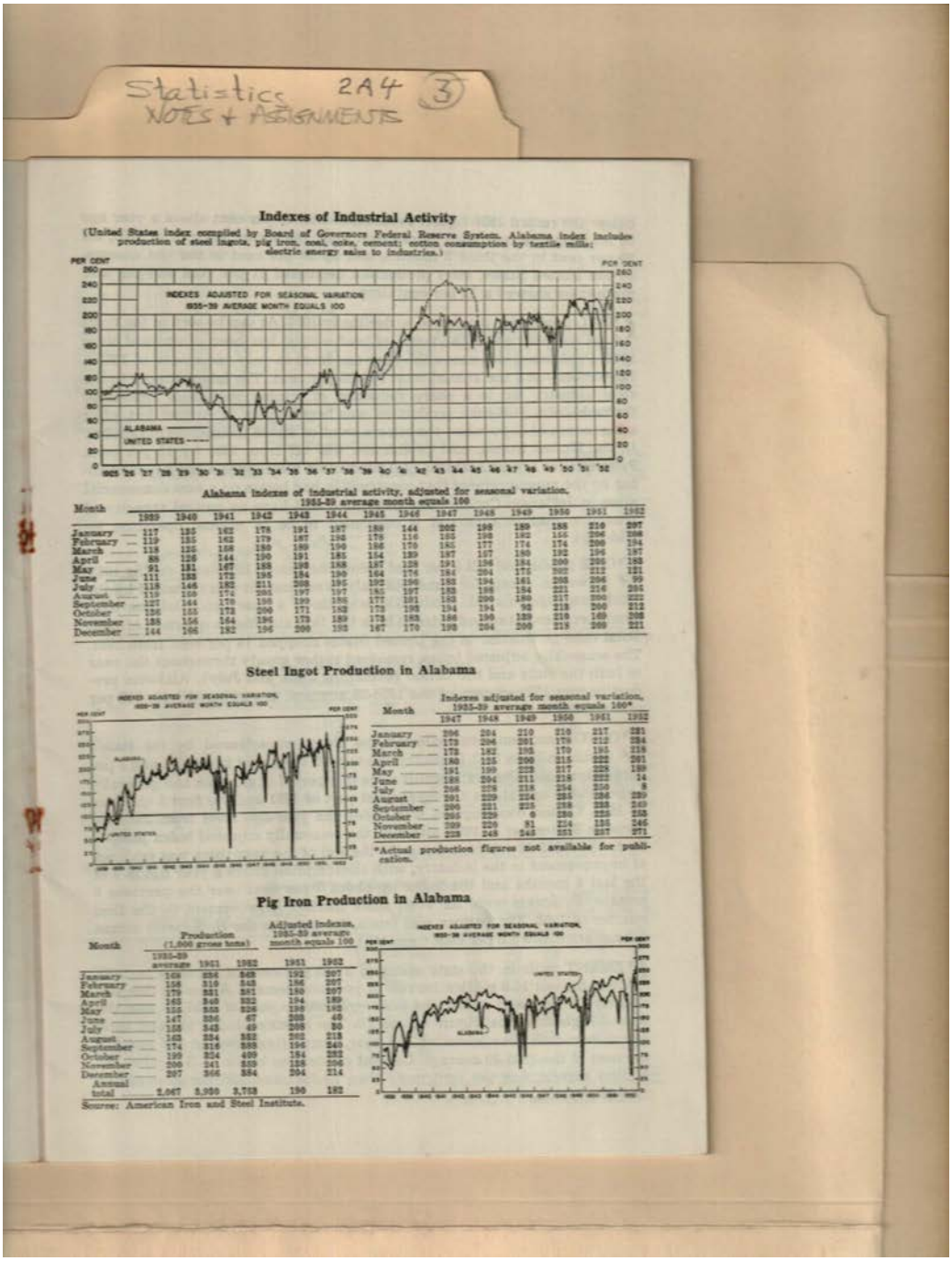

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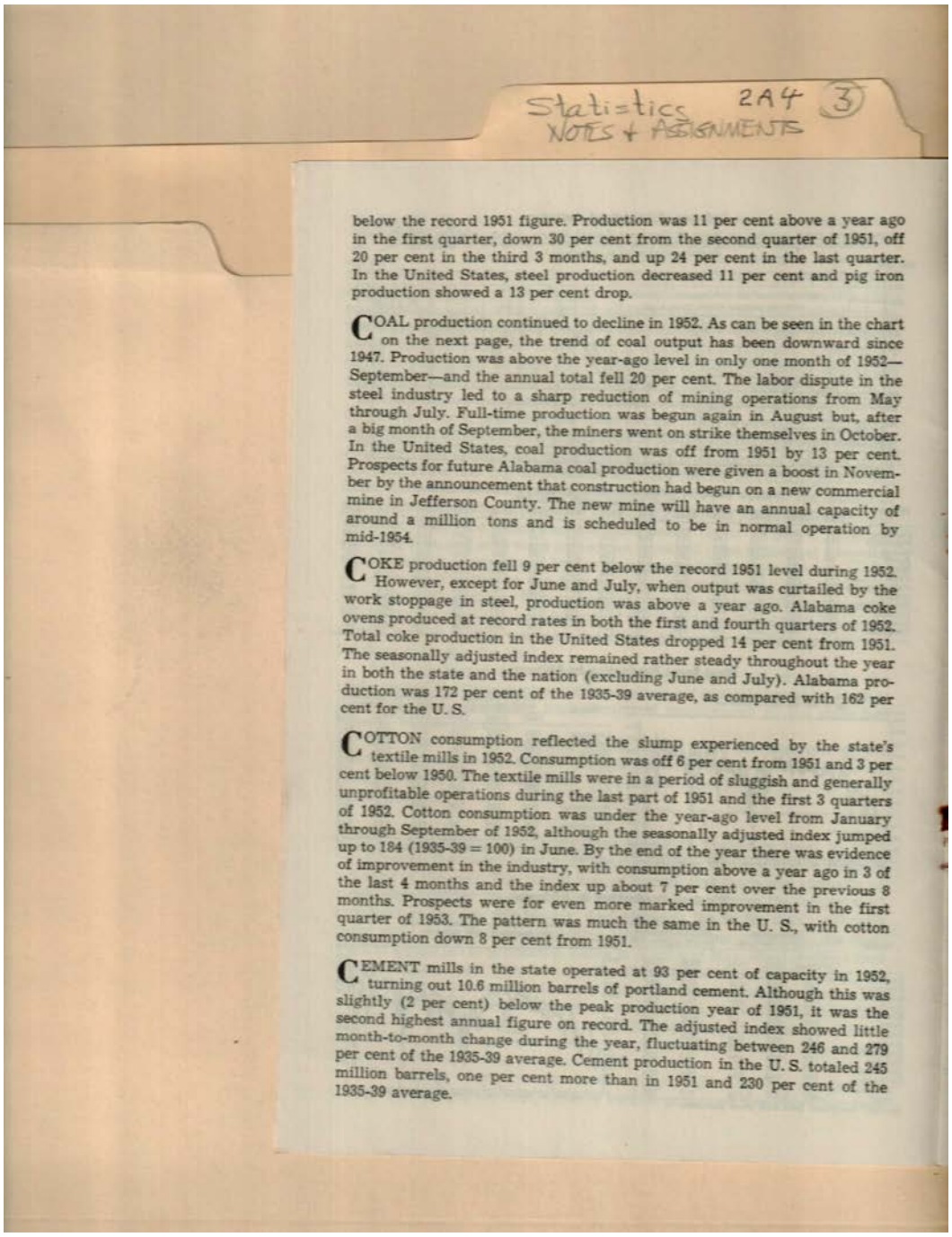

below the record 1951 figure. Production was 11 per cent above a year ago in the first quarter, down 30 per cent from the second quarter of 1951, off 20 per cent in the third 3 months, and up 24 per cent in the last quarter. In the United States, steel production decreased 11 per cent and pig iron production showed a 13 per cent drop.

COAL production continued to decline in 1952. As can be seen in the chart on the next page, the trend of coal output has been downward since 1947. Production was above the year-ago level in only one month of 1952—September—and the annual total fell 20 per cent. The labor dispute in the steel industry led to a sharp reduction of mining operations from May through July. Full-time production was begun again in August but, after a big month of September, the miners went on strike themselves in October. In the United States, coal production was off from 1951 by 13 per cent. Prospects for future Alabama coal production were given a boost in November by the announcement that construction had begun on a new commercial mine in Jefferson County. The new mine will have an annual capacity of around a million tons and is scheduled to be in normal operation by mid-1954.

COKE production fell 9 per cent below the record 1951 level during 1952. However, except for June and July, when output was curtailed by the work stoppage in steel, production was above a year ago. Alabama coke ovens produced at record rates in both the first and fourth quarters of 1952. Total coke production in the United States dropped 14 per cent from 1951. The seasonally adjusted index remained rather steady throughout the year in both the state and the nation (excluding June and July). Alabama production was 172 per cent of the 1935-39 average, as compared with 162 per cent for the U. S.

COTTON consumption reflected the slump experienced by the state's textile mills in 1952. Consumption was off 6 per cent from 1951 and 3 per cent below 1950. The textile mills were in a period of sluggish and generally unprofitable operations during the last part of 1951 and the first 3 quarters of 1952. Cotton consumption was under the year-ago level from January through September of 1952, although the seasonally adjusted index jumped up to 184 (1935-39 = 100) in June. By the end of the year there was evidence of improvement in the industry, with consumption above a year ago in 3 of the last 4 months and the index up about 7 per cent over the previous 8 months. Prospects were for even more marked improvement in the first quarter of 1953. The pattern was much the same in the U. S., with cotton consumption down 8 per cent from 1951.

CEMENT mills in the state operated at 93 per cent of capacity in 1952, turning out 10.6 million barrels of portland cement. Although this was slightly (2 per cent) below the peak production year of 1951, it was the second highest annual figure on record. The adjusted index showed little month-to-month change during the year, fluctuating between 246 and 279 per cent of the 1935-39 average. Cement production in the U. S. totaled 245 million barrels, one per cent more than in 1951 and 230 per cent of the 1935-39 average.

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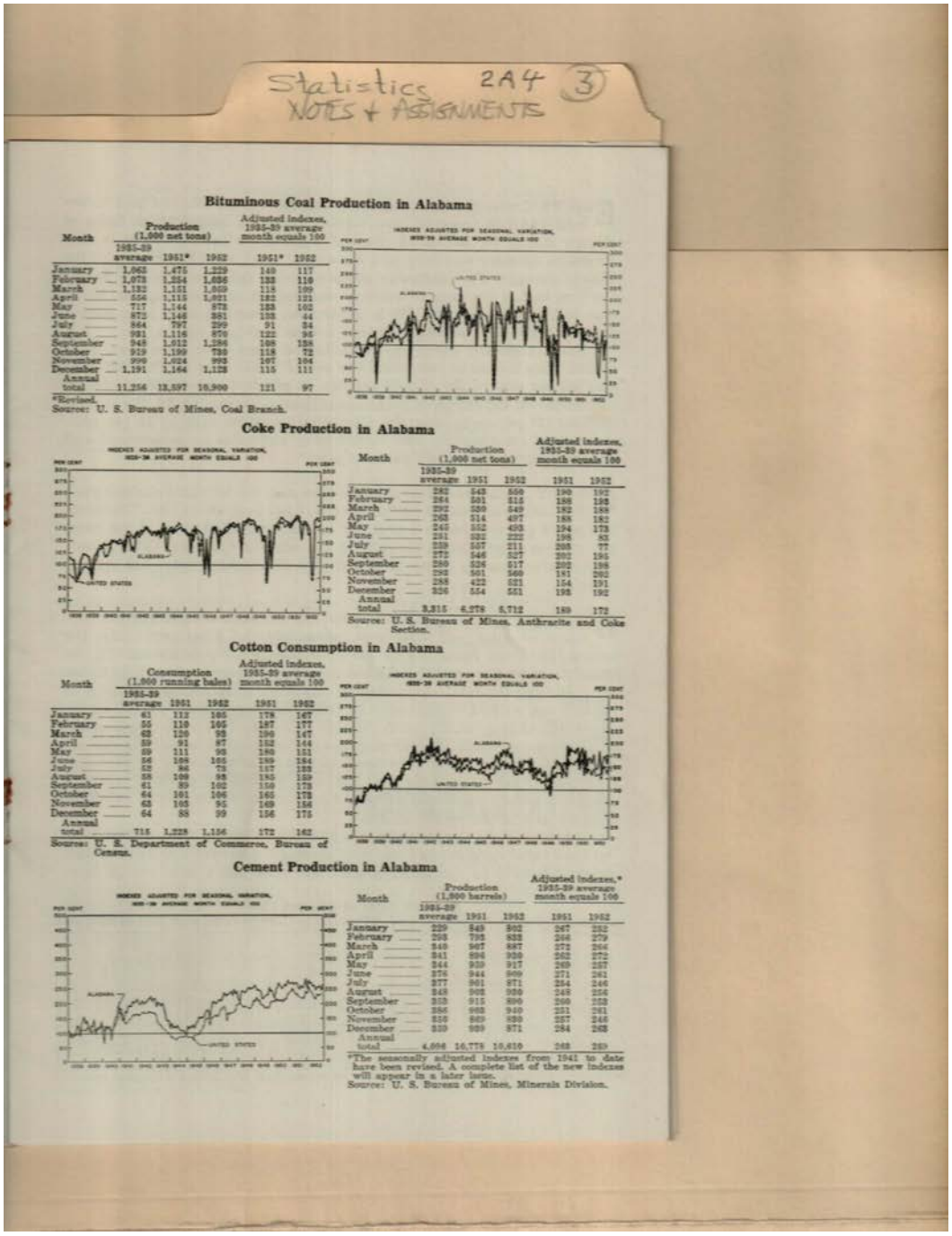

Bituminous Coal Production in Alabama

Month	Production (1,000 net tons) 1935-39 average	1951*	1952	Adjusted indexes, 1935-39 average month equals 100 1951*	1952
January	1,062	1,475	1,229	140	117
February	1,078	1,354	1,036	133	110
March	1,132	1,131	1,050	118	109
April	856	1,115	1,021	132	121
May	717	1,144	878	163	102
June	872	1,146	881	133	44
July	944	797	299	91	34
August	981	1,116	870	122	96
September	948	1,012	1,286	108	158
October	919	1,190	720	118	72
November	999	1,024	993	107	104
December	1,191	1,164	1,128	115	111
Annual total	11,254	13,597	10,900	121	97

*Revised.
Source: U. S. Bureau of Mines, Coal Branch.

Coke Production in Alabama

Month	Production (1,000 net tons) 1935-39 average	1951	1952	Adjusted indexes, 1935-39 average month equals 100 1951	1952
January	282	543	550	190	192
February	264	501	518	188	188
March	292	520	549	182	188
April	268	514	497	188	182
May	245	552	493	194	178
June	251	502	222	196	83
July	239	507	211	205	77
August	272	546	527	202	194
September	260	526	517	202	198
October	293	501	560	191	202
November	288	422	521	154	191
December	326	554	561	198	192
Annual total	3,315	6,078	5,712	189	172

Source: U. S. Bureau of Mines, Anthracite and Coke Section.

Cotton Consumption in Alabama

Month	Consumption (1,000 running bales) 1935-39 average	1951	1952	Adjusted indexes, 1935-39 average month equals 100 1951	1952
January	61	113	105	178	147
February	55	110	105	187	177
March	62	120	93	190	147
April	59	91	87	152	144
May	59	111	93	180	151
June	56	105	105	189	184
July	53	84	73	157	133
August	58	109	93	183	159
September	61	89	102	150	173
October	64	101	106	161	173
November	62	105	91	169	156
December	64	88	99	156	173
Annual total	715	1,228	1,156	172	162

Source: U. S. Department of Commerce, Bureau of Census.

Cement Production in Alabama

Month	Production (1,000 barrels) 1935-39 average	1951	1952	Adjusted indexes,* 1935-39 average month equals 100 1951	1952
January	229	649	602	267	252
February	208	705	638	304	279
March	240	907	887	372	364
April	241	896	930	362	372
May	244	939	917	369	357
June	276	944	909	371	341
July	277	901	871	354	346
August	248	908	930	349	356
September	253	915	890	366	353
October	256	903	940	351	361
November	256	869	930	337	348
December	230	909	871	354	338
Annual total	4,006	10,775	10,610	342	339

*The seasonally adjusted indexes from 1941 to date have been revised. A complete list of the new indexes will appear in a later issue.
Source: U. S. Bureau of Mines, Minerals Division.

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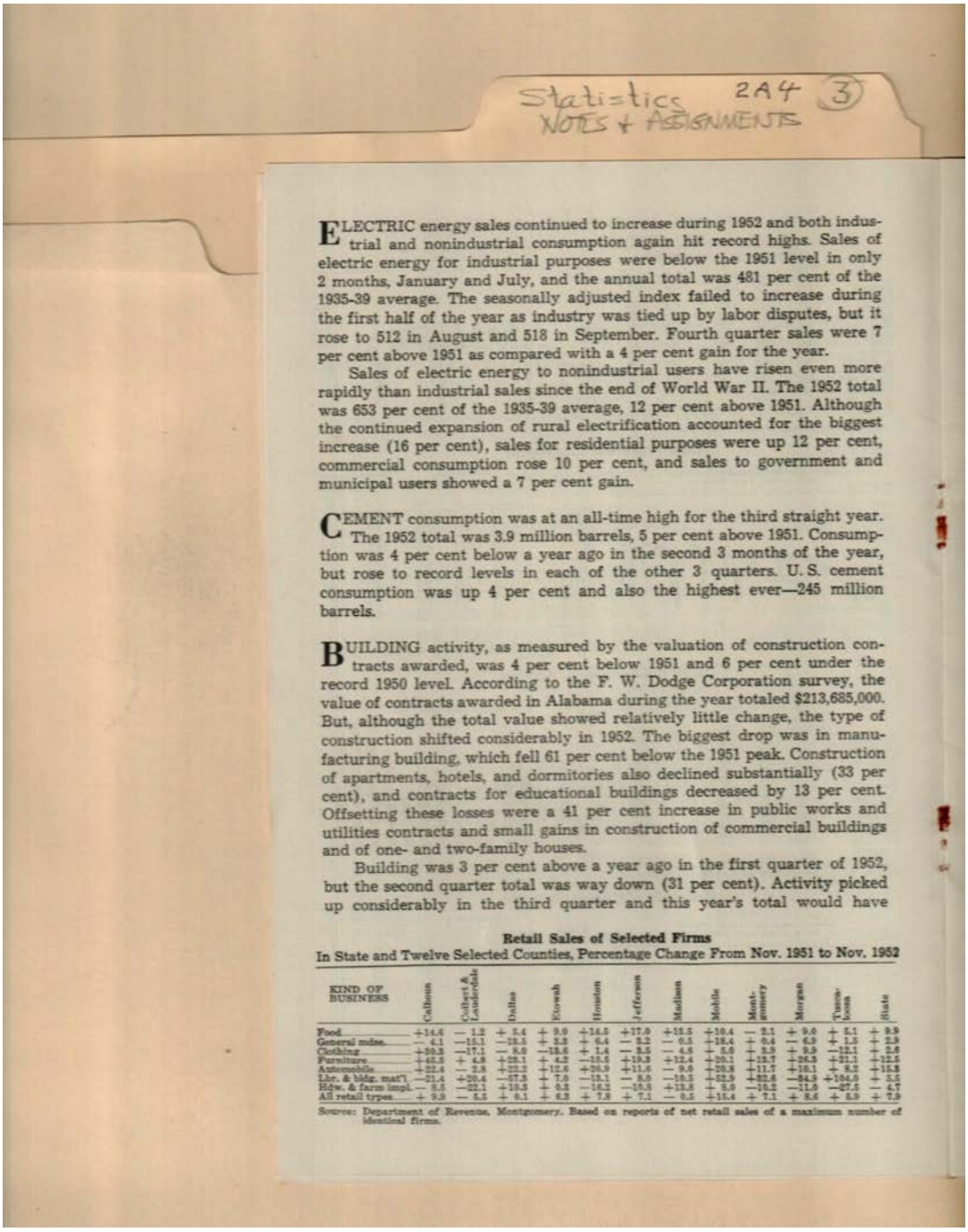

ELECTRIC energy sales continued to increase during 1952 and both industrial and nonindustrial consumption again hit record highs. Sales of electric energy for industrial purposes were below the 1951 level in only 2 months, January and July, and the annual total was 481 per cent of the 1935-39 average. The seasonally adjusted index failed to increase during the first half of the year as industry was tied up by labor disputes, but it rose to 512 in August and 518 in September. Fourth quarter sales were 7 per cent above 1951 as compared with a 4 per cent gain for the year.

Sales of electric energy to nonindustrial users have risen even more rapidly than industrial sales since the end of World War II. The 1952 total was 653 per cent of the 1935-39 average, 12 per cent above 1951. Although the continued expansion of rural electrification accounted for the biggest increase (16 per cent), sales for residential purposes were up 12 per cent, commercial consumption rose 10 per cent, and sales to government and municipal users showed a 7 per cent gain.

CEMENT consumption was at an all-time high for the third straight year. The 1952 total was 3.9 million barrels, 5 per cent above 1951. Consumption was 4 per cent below a year ago in the second 3 months of the year, but rose to record levels in each of the other 3 quarters. U. S. cement consumption was up 4 per cent and also the highest ever—245 million barrels.

BUILDING activity, as measured by the valuation of construction contracts awarded, was 4 per cent below 1951 and 6 per cent under the record 1950 level. According to the F. W. Dodge Corporation survey, the value of contracts awarded in Alabama during the year totaled $213,685,000. But, although the total value showed relatively little change, the type of construction shifted considerably in 1952. The biggest drop was in manufacturing building, which fell 61 per cent below the 1951 peak. Construction of apartments, hotels, and dormitories also declined substantially (33 per cent), and contracts for educational buildings decreased by 13 per cent. Offsetting these losses were a 41 per cent increase in public works and utilities contracts and small gains in construction of commercial buildings and of one- and two-family houses.

Building was 3 per cent above a year ago in the first quarter of 1952, but the second quarter total was way down (31 per cent). Activity picked up considerably in the third quarter and this year's total would have

Retail Sales of Selected Firms
In State and Twelve Selected Counties, Percentage Change From Nov. 1951 to Nov. 1952

KIND OF BUSINESS	Calhoun	Colbert & Lauderdale	Dallas	Etowah	Houston	Jefferson	Madison	Mobile	Montgomery	Morgan	Tuscaloosa	State
Food	+14.6	— 1.2	+ 5.4	+ 9.0	+14.5	+17.0	+13.5	+10.4	— 2.1	+ 9.0	+ 5.1	+ 9.9
General mdse.	— 4.1	—15.1	—28.1	+ 2.3	+ 6.4	— 8.2	— 0.5	+18.4	+ 0.4	— 6.9	+ 1.5	+ 2.3
Clothing	+20.3	—17.1	— 8.0	—13.6	+ 1.4	— 8.5	— 4.6	+ 5.0	+ 2.3	+ 9.9	—12.1	+ 2.6
Furniture	+43.8	+ 4.8	+28.1	+ 4.2	—15.5	+19.3	+12.4	+20.1	+18.7	+26.8	+21.1	+12.5
Automobile	+22.4	— 2.8	+22.2	+12.6	+26.9	+11.6	— 9.0	+20.8	+11.7	+16.1	+ 8.2	+15.8
Lbr. & bldg. mat'l	—21.4	+20.4	—37.8	+ 7.0	—13.1	— 8.0	—18.5	+12.9	+82.6	—84.9	+194.9	+ 5.5
Hdw. & farm impl.	— 5.5	—22.1	+16.5	+ 0.3	—14.2	—16.0	+13.6	+ 5.0	—16.2	—11.0	—27.5	— 4.7
All retail types	+ 9.9	— 5.5	+ 0.1	+ 6.3	+ 7.8	+ 7.1	— 0.5	+15.4	+ 7.1	+ 8.6	+ 8.9	+ 7.9

Source: Department of Revenue, Montgomery. Based on reports of net retail sales of a maximum number of identical firms.

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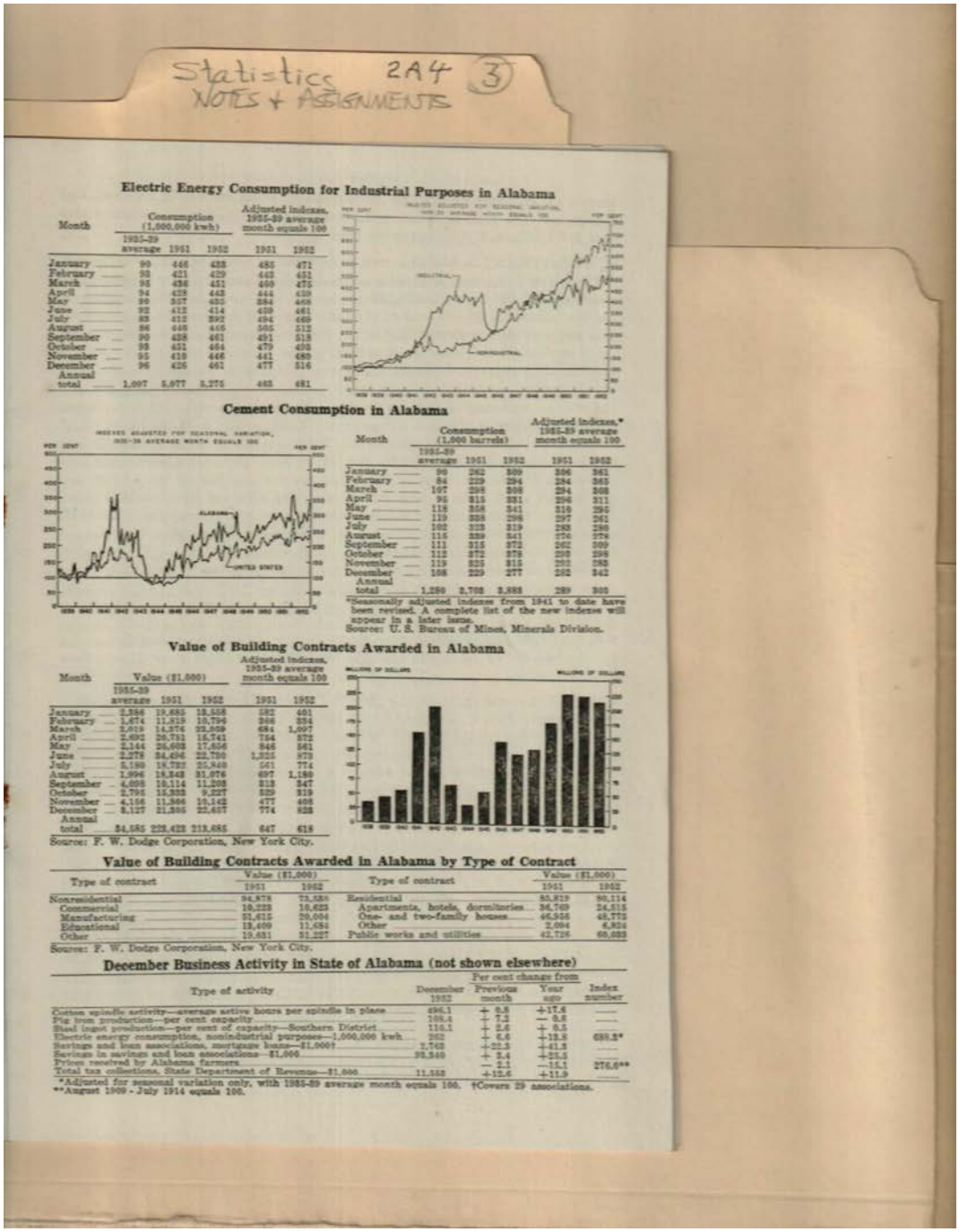

Electric Energy Consumption for Industrial Purposes in Alabama

Month	Consumption (1,000,000 kwh) 1935-39 average	1951	1952	Adjusted indexes, 1935-39 average month equals 100 1951	1952
January	90	446	433	485	471
February	93	421	429	443	451
March	95	436	451	449	475
April	94	429	443	444	459
May	90	397	435	394	468
June	92	412	414	439	461
July	83	412	392	494	469
August	86	440	446	505	512
September	90	428	461	491	518
October	93	431	464	479	498
November	95	419	446	441	480
December	96	426	461	477	516
Annual total	1,097	5,077	5,275	463	481

Cement Consumption in Alabama

Month	Consumption (1,000 barrels) 1935-39 average	1951	1952	Adjusted indexes,* 1935-39 average month equals 100. 1951	1952
January	90	262	309	306	361
February	84	229	294	284	365
March	107	268	308	284	308
April	93	315	321	296	311
May	118	358	341	310	295
June	119	333	298	297	261
July	102	323	319	283	280
August	116	339	341	276	278
September	111	315	372	262	309
October	112	372	378	293	293
November	119	323	315	263	283
December	108	229	277	282	342
Annual total	1,280	3,768	3,888	289	303

*Seasonally adjusted indexes from 1941 to date have been revised. A complete list of the new indexes will appear in a later issue.
Source: U. S. Bureau of Mines, Minerals Division.

Value of Building Contracts Awarded in Alabama

Month	Value ($1,000) 1935-39 average	1951	1952	Adjusted indexes, 1935-39 average month equals 100 1951	1952
January	2,386	19,685	18,558	382	401
February	1,674	11,819	10,796	366	354
March	2,019	14,374	22,009	484	1,097
April	2,602	20,781	16,741	764	572
May	2,144	26,608	17,656	946	561
June	2,278	34,496	22,730	1,315	879
July	5,180	19,721	25,848	561	774
August	1,996	18,548	31,976	697	1,180
September	4,008	10,114	11,208	313	347
October	2,795	14,333	9,227	529	319
November	4,156	11,566	10,142	477	408
December	8,127	21,305	22,617	774	828
Annual total	$4,585	228,423	213,685	647	618

Source: F. W. Dodge Corporation, New York City.

Value of Building Contracts Awarded in Alabama by Type of Contract

Type of contract	Value ($1,000) 1951	1952	Type of contract	Value ($1,000) 1951	1952
Nonresidential	94,878	73,538	Residential	85,819	80,114
Commercial	10,228	16,623	Apartments, hotels, dormitories	34,769	24,515
Manufacturing	51,615	20,004	One- and two-family houses	46,956	48,776
Educational	13,409	11,684	Other	2,094	6,824
Other	19,631	21,227	Public works and utilities	42,726	60,033

Source: F. W. Dodge Corporation, New York City.

December Business Activity in State of Alabama (not shown elsewhere)

Type of activity	December 1952	Per cent change from Previous month	Per cent change from Year ago	Index number
Cotton spindle activity—average active hours per spindle in place	496.1	+ 0.8	+17.4	.....
Pig iron production—per cent capacity	108.4	+ 7.2	— 6.6	.....
Steel ingot production—per cent of capacity—Southern District	110.1	+ 2.6	+ 0.1	.....
Electric energy consumption, nonindustrial purposes—1,000,000 kwh	262	+ 6.6	+13.8	688.8*
Savings and loan associations, mortgage loans—$1,000†	2,763	+22.3	+41.8	.....
Savings in savings and loan associations—$1,000	93,340	+ 2.4	+25.5	.....
Prices received by Alabama farmers	.....	— 2.1	—15.1	276.0**
Total tax collections, State Department of Revenue—$1,000	11,552	+12.6	+11.9	.....

*Adjusted for seasonal variation only, with 1935-39 average month equals 100. †Covers 29 associations.
**August 1909 - July 1914 equals 100.

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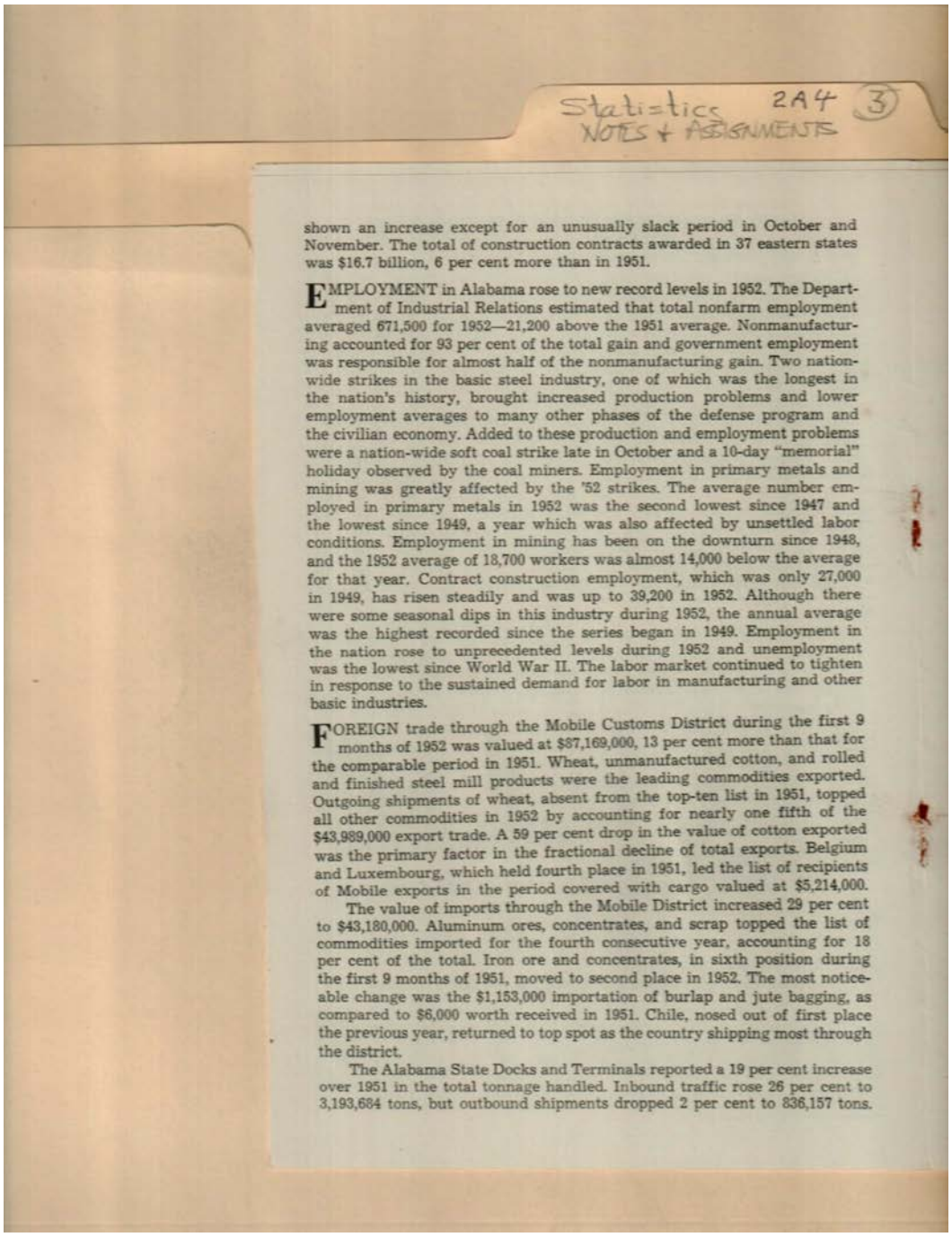

shown an increase except for an unusually slack period in October and November. The total of construction contracts awarded in 37 eastern states was $16.7 billion, 6 per cent more than in 1951.

EMPLOYMENT in Alabama rose to new record levels in 1952. The Department of Industrial Relations estimated that total nonfarm employment averaged 671,500 for 1952—21,200 above the 1951 average. Nonmanufacturing accounted for 93 per cent of the total gain and government employment was responsible for almost half of the nonmanufacturing gain. Two nationwide strikes in the basic steel industry, one of which was the longest in the nation's history, brought increased production problems and lower employment averages to many other phases of the defense program and the civilian economy. Added to these production and employment problems were a nation-wide soft coal strike late in October and a 10-day "memorial" holiday observed by the coal miners. Employment in primary metals and mining was greatly affected by the '52 strikes. The average number employed in primary metals in 1952 was the second lowest since 1947 and the lowest since 1949, a year which was also affected by unsettled labor conditions. Employment in mining has been on the downturn since 1948, and the 1952 average of 18,700 workers was almost 14,000 below the average for that year. Contract construction employment, which was only 27,000 in 1949, has risen steadily and was up to 39,200 in 1952. Although there were some seasonal dips in this industry during 1952, the annual average was the highest recorded since the series began in 1949. Employment in the nation rose to unprecedented levels during 1952 and unemployment was the lowest since World War II. The labor market continued to tighten in response to the sustained demand for labor in manufacturing and other basic industries.

FOREIGN trade through the Mobile Customs District during the first 9 months of 1952 was valued at $87,169,000, 13 per cent more than that for the comparable period in 1951. Wheat, unmanufactured cotton, and rolled and finished steel mill products were the leading commodities exported. Outgoing shipments of wheat, absent from the top-ten list in 1951, topped all other commodities in 1952 by accounting for nearly one fifth of the $43,989,000 export trade. A 59 per cent drop in the value of cotton exported was the primary factor in the fractional decline of total exports. Belgium and Luxembourg, which held fourth place in 1951, led the list of recipients of Mobile exports in the period covered with cargo valued at $5,214,000.

The value of imports through the Mobile District increased 29 per cent to $43,180,000. Aluminum ores, concentrates, and scrap topped the list of commodities imported for the fourth consecutive year, accounting for 18 per cent of the total. Iron ore and concentrates, in sixth position during the first 9 months of 1951, moved to second place in 1952. The most noticeable change was the $1,153,000 importation of burlap and jute bagging, as compared to $6,000 worth received in 1951. Chile, nosed out of first place the previous year, returned to top spot as the country shipping most through the district.

The Alabama State Docks and Terminals reported a 19 per cent increase over 1951 in the total tonnage handled. Inbound traffic rose 26 per cent to 3,193,684 tons, but outbound shipments dropped 2 per cent to 836,157 tons.

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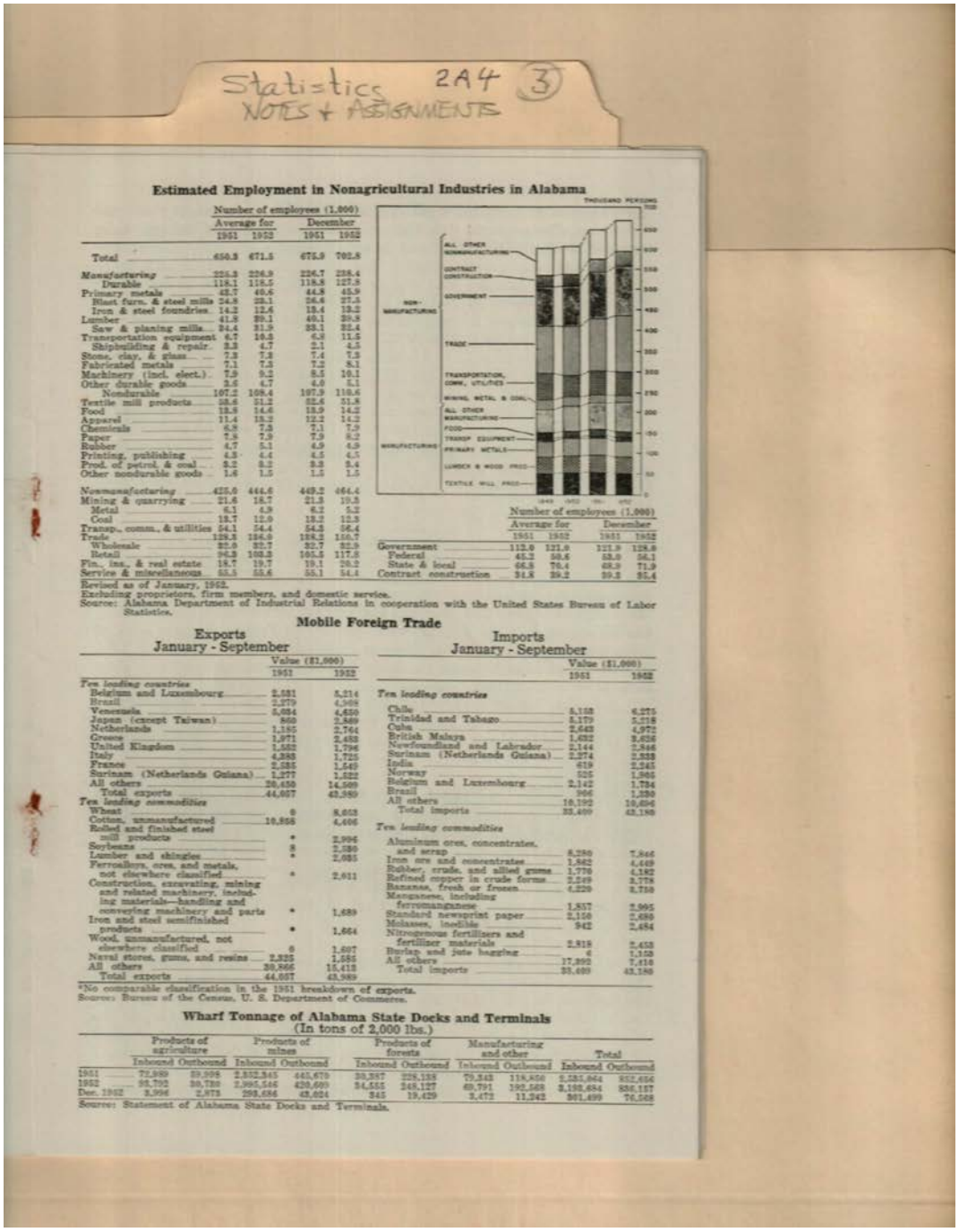

Estimated Employment in Nonagricultural Industries in Alabama

	Number of employees (1,000) Average for 1951	Average for 1952	December 1951	December 1952
Total	650.3	671.5	675.9	702.8
Manufacturing	226.3	226.9	226.7	238.4
Durable	118.1	118.5	118.8	127.8
Primary metals	43.7	40.6	44.8	45.9
Blast furn. & steel mills	24.8	23.1	26.6	27.5
Iron & steel foundries	14.2	12.6	13.4	13.2
Lumber	41.8	39.1	40.1	39.8
Saw & planing mills	34.4	31.9	33.1	32.4
Transportation equipment	6.7	10.3	6.8	11.5
Shipbuilding & repair	3.3	4.7	2.1	4.5
Stone, clay, & glass	7.3	7.3	7.4	7.3
Fabricated metals	7.1	7.3	7.3	8.1
Machinery (incl. elect.)	7.9	9.2	8.5	10.1
Other durable goods	3.6	4.7	4.0	5.1
Nondurable	107.2	108.4	107.9	110.6
Textile mill products	48.6	51.2	52.6	51.8
Food	13.5	14.6	13.9	14.2
Apparel	11.4	13.2	12.2	14.2
Chemicals	6.8	7.3	7.1	7.9
Paper	7.8	7.9	7.9	8.2
Rubber	4.7	5.1	4.9	4.9
Printing, publishing	4.3	4.4	4.5	4.5
Prod. of petrol. & coal	8.2	8.2	8.8	8.4
Other nondurable goods	1.6	1.5	1.5	1.5
Nonmanufacturing	423.9	444.6	449.2	464.4
Mining & quarrying	21.6	18.7	21.3	19.5
Metal	6.1	4.9	6.2	5.2
Coal	13.7	12.0	13.2	12.3
Transp., comm., & utilities	54.1	54.4	54.5	56.4
Trade	128.3	134.0	134.3	140.7
Wholesale	32.0	32.7	32.7	32.9
Retail	96.3	100.3	101.5	117.8
Fin., ins., & real estate	18.7	19.7	19.1	20.2
Service & miscellaneous	55.5	55.6	55.1	54.4

Revised as of January, 1952.
Excluding proprietors, firm members, and domestic service.
Source: Alabama Department of Industrial Relations in cooperation with the United States Bureau of Labor Statistics.

	Number of employees (1,000) Average for 1951	Average for 1952	December 1951	December 1952
Government	112.0	121.0	121.9	128.0
Federal	45.2	50.6	53.0	56.1
State & local	66.8	70.4	68.9	71.9
Contract construction	31.8	39.2	39.8	35.4

Mobile Foreign Trade

Exports
January - September

	Value ($1,000) 1951	1952
Ten leading countries		
Belgium and Luxembourg	2,581	5,214
Brazil	2,279	4,508
Venezuela	5,084	4,450
Japan (except Taiwan)	860	2,849
Netherlands	1,185	2,764
Greece	1,971	2,482
United Kingdom	1,552	1,796
Italy	4,588	1,725
France	2,585	1,549
Surinam (Netherlands Guiana)	1,277	1,522
All others	20,450	14,509
Total exports	44,057	43,389
Ten leading commodities		
Wheat	0	8,053
Cotton, unmanufactured	10,956	4,406
Rolled and finished steel mill products	*	2,996
Soybeans	8	2,280
Lumber and shingles	*	2,085
Ferroalloys, ores, and metals, not elsewhere classified	*	2,011
Construction, excavating, mining and related machinery, including materials—handling and conveying machinery and parts	*	1,689
Iron and steel semifinished products	*	1,664
Wood, unmanufactured, not elsewhere classified	0	1,607
Naval stores, gums, and resins	2,325	1,585
All others	20,966	15,413
Total exports	44,057	43,389

*No comparable classification in the 1951 breakdown of exports.
Source: Bureau of the Census, U. S. Department of Commerce.

Imports
January - September

	Value ($1,000) 1951	1952
Ten leading countries		
Chile	5,158	6,275
Trinidad and Tobago	5,179	5,218
Cuba	2,642	4,972
British Malaya	1,632	3,658
Newfoundland and Labrador	2,144	2,846
Surinam (Netherlands Guiana)	2,274	2,338
India	619	2,243
Norway	525	1,965
Belgium and Luxembourg	2,142	1,784
Brazil	966	1,250
All others	10,192	10,606
Total imports	33,469	43,180
Ten leading commodities		
Aluminum ores, concentrates, and scrap	6,280	7,946
Iron ore and concentrates	1,562	4,449
Rubber, crude, and allied gums	1,776	4,182
Refined copper in crude forms	2,249	3,778
Bananas, fresh or frozen	1,229	2,750
Manganese, including ferromanganese	1,857	2,905
Standard newsprint paper	2,156	2,680
Molasses, inedible	942	2,454
Nitrogenous fertilizers and fertilizer materials	2,918	2,453
Burlap and jute bagging	6	1,152
All others	17,292	7,418
Total imports	33,469	43,180

Wharf Tonnage of Alabama State Docks and Terminals
(In tons of 2,000 lbs.)

	Products of agriculture Inbound	Outbound	Products of mines Inbound	Outbound	Products of forests Inbound	Outbound	Manufacturing and other Inbound	Outbound	Total Inbound	Outbound
1951	72,989	39,998	2,832,345	445,670	39,397	228,139	79,343	118,850	3,024,074	832,656
1952	98,702	30,720	2,995,546	420,609	54,555	248,127	40,791	192,568	3,190,594	890,127
Dec. 1952	3,996	2,873	293,686	43,024	345	19,429	3,472	11,242	301,499	76,568

Source: Statement of Alabama State Docks and Terminals.

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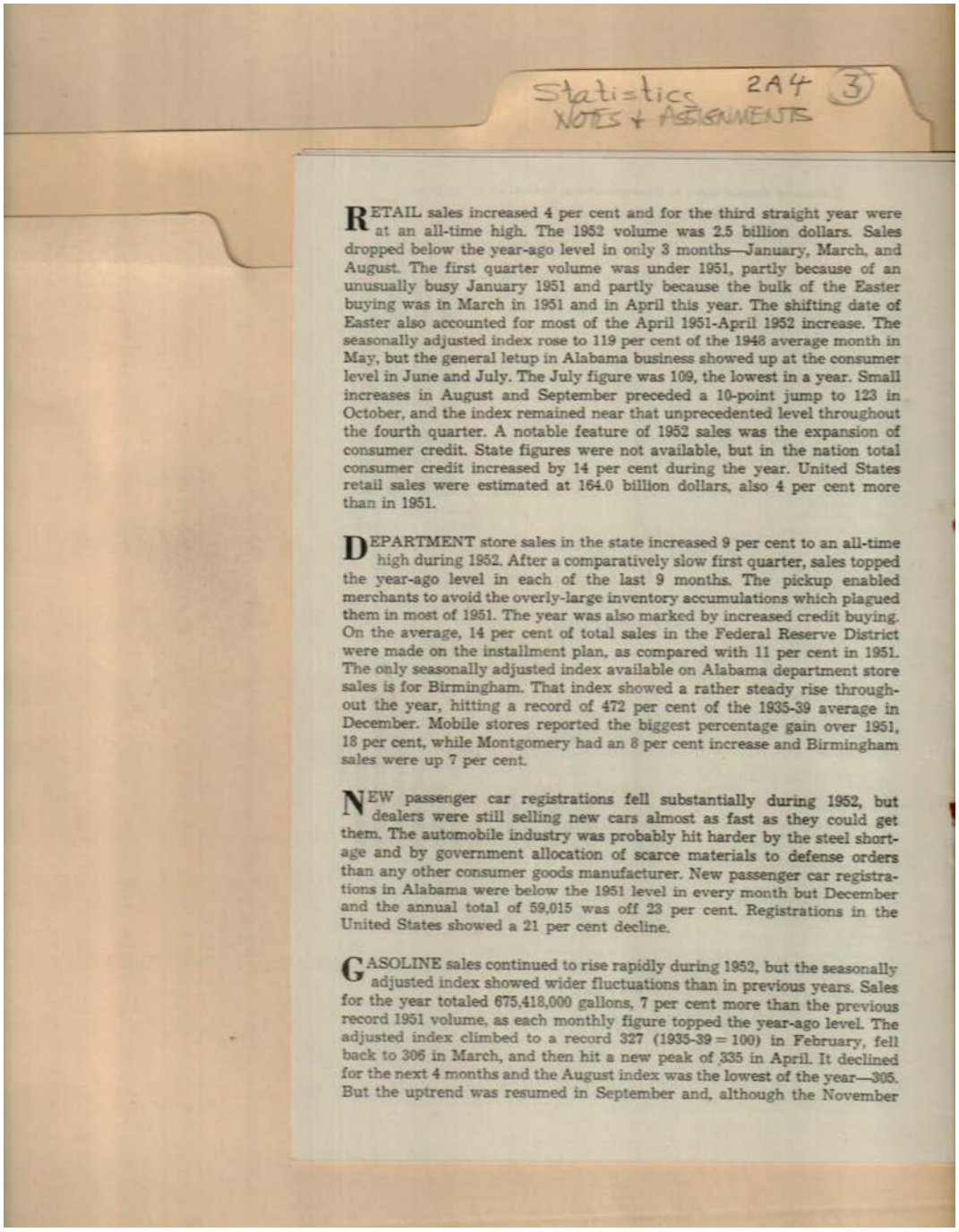

RETAIL sales increased 4 per cent and for the third straight year were at an all-time high. The 1952 volume was 2.5 billion dollars. Sales dropped below the year-ago level in only 3 months—January, March, and August. The first quarter volume was under 1951, partly because of an unusually busy January 1951 and partly because the bulk of the Easter buying was in March in 1951 and in April this year. The shifting date of Easter also accounted for most of the April 1951-April 1952 increase. The seasonally adjusted index rose to 119 per cent of the 1948 average month in May, but the general letup in Alabama business showed up at the consumer level in June and July. The July figure was 109, the lowest in a year. Small increases in August and September preceded a 10-point jump to 123 in October, and the index remained near that unprecedented level throughout the fourth quarter. A notable feature of 1952 sales was the expansion of consumer credit. State figures were not available, but in the nation total consumer credit increased by 14 per cent during the year. United States retail sales were estimated at 164.0 billion dollars, also 4 per cent more than in 1951.

DEPARTMENT store sales in the state increased 9 per cent to an all-time high during 1952. After a comparatively slow first quarter, sales topped the year-ago level in each of the last 9 months. The pickup enabled merchants to avoid the overly-large inventory accumulations which plagued them in most of 1951. The year was also marked by increased credit buying. On the average, 14 per cent of total sales in the Federal Reserve District were made on the installment plan, as compared with 11 per cent in 1951. The only seasonally adjusted index available on Alabama department store sales is for Birmingham. That index showed a rather steady rise throughout the year, hitting a record of 472 per cent of the 1935-39 average in December. Mobile stores reported the biggest percentage gain over 1951, 18 per cent, while Montgomery had an 8 per cent increase and Birmingham sales were up 7 per cent.

NEW passenger car registrations fell substantially during 1952, but dealers were still selling new cars almost as fast as they could get them. The automobile industry was probably hit harder by the steel shortage and by government allocation of scarce materials to defense orders than any other consumer goods manufacturer. New passenger car registrations in Alabama were below the 1951 level in every month but December and the annual total of 59,015 was off 23 per cent. Registrations in the United States showed a 21 per cent decline.

GASOLINE sales continued to rise rapidly during 1952, but the seasonally adjusted index showed wider fluctuations than in previous years. Sales for the year totaled 675,418,000 gallons, 7 per cent more than the previous record 1951 volume, as each monthly figure topped the year-ago level. The adjusted index climbed to a record 327 (1935-39 = 100) in February, fell back to 306 in March, and then hit a new peak of 335 in April. It declined for the next 4 months and the August index was the lowest of the year—305. But the uptrend was resumed in September and, although the November

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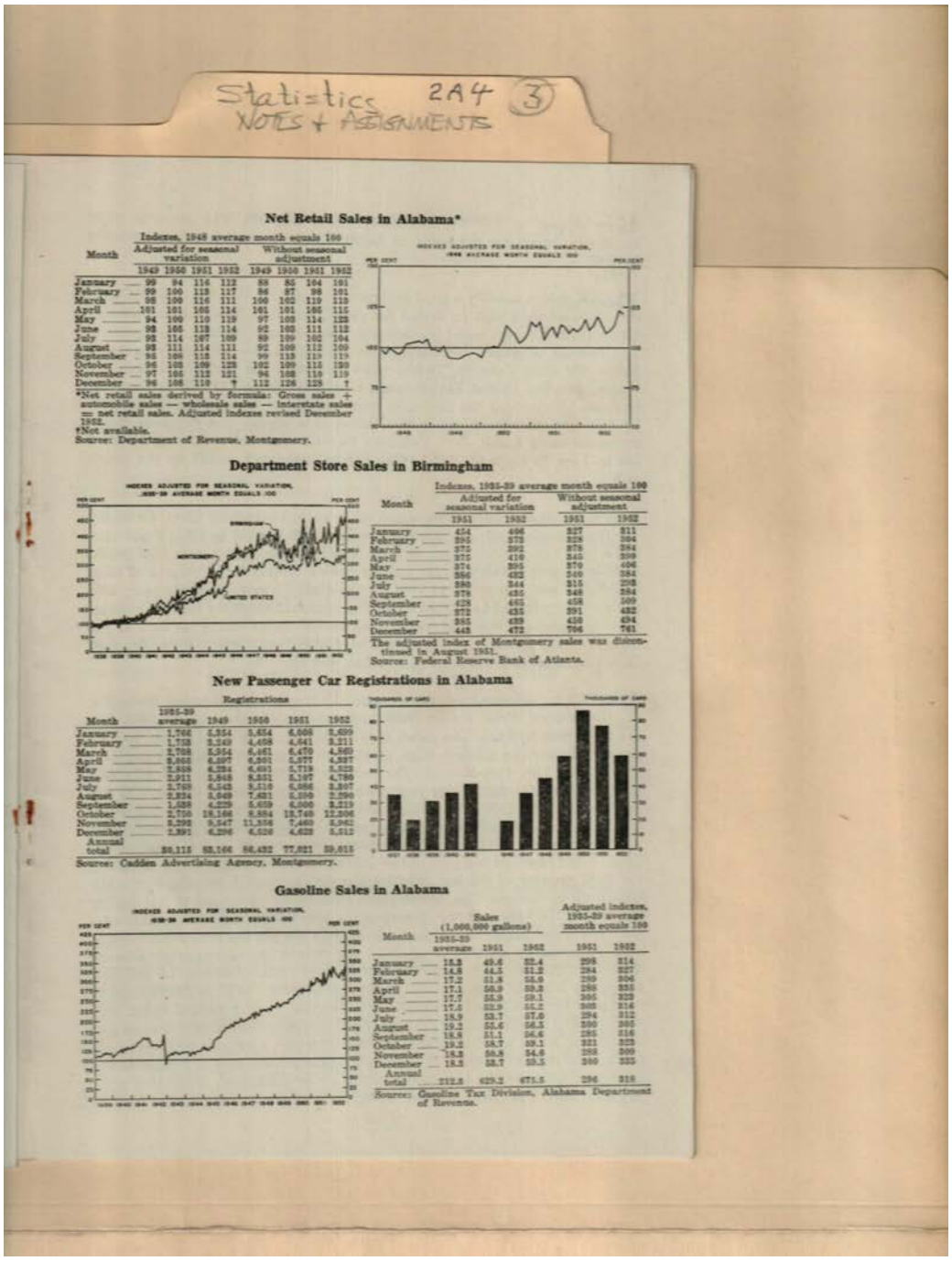

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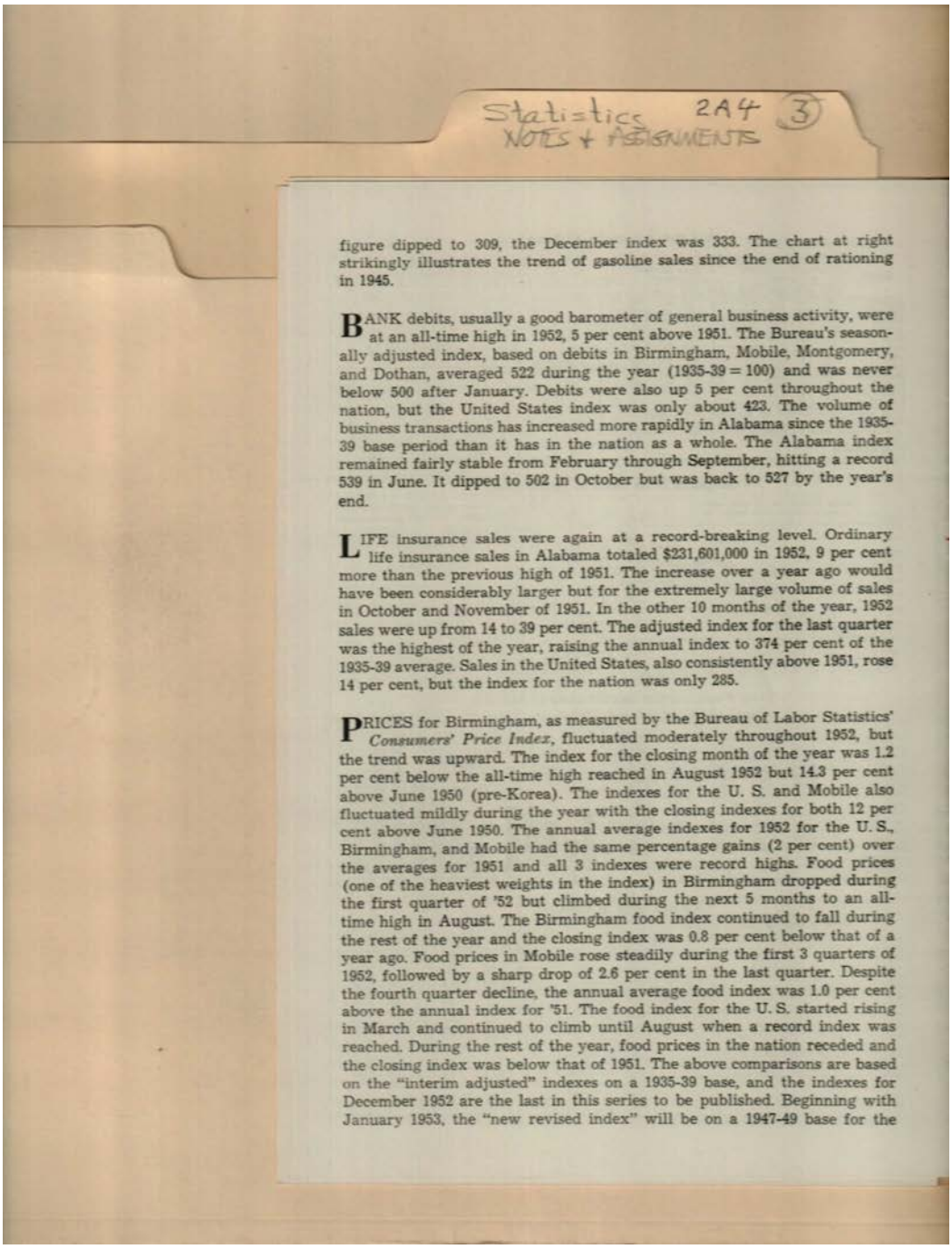

figure dipped to 309, the December index was 333. The chart at right strikingly illustrates the trend of gasoline sales since the end of rationing in 1945.

BANK debits, usually a good barometer of general business activity, were at an all-time high in 1952, 5 per cent above 1951. The Bureau's seasonally adjusted index, based on debits in Birmingham, Mobile, Montgomery, and Dothan, averaged 522 during the year (1935-39 = 100) and was never below 500 after January. Debits were also up 5 per cent throughout the nation, but the United States index was only about 423. The volume of business transactions has increased more rapidly in Alabama since the 1935-39 base period than it has in the nation as a whole. The Alabama index remained fairly stable from February through September, hitting a record 539 in June. It dipped to 502 in October but was back to 527 by the year's end.

LIFE insurance sales were again at a record-breaking level. Ordinary life insurance sales in Alabama totaled $231,601,000 in 1952, 9 per cent more than the previous high of 1951. The increase over a year ago would have been considerably larger but for the extremely large volume of sales in October and November of 1951. In the other 10 months of the year, 1952 sales were up from 14 to 39 per cent. The adjusted index for the last quarter was the highest of the year, raising the annual index to 374 per cent of the 1935-39 average. Sales in the United States, also consistently above 1951, rose 14 per cent, but the index for the nation was only 285.

PRICES for Birmingham, as measured by the Bureau of Labor Statistics' *Consumers' Price Index*, fluctuated moderately throughout 1952, but the trend was upward. The index for the closing month of the year was 1.2 per cent below the all-time high reached in August 1952 but 14.3 per cent above June 1950 (pre-Korea). The indexes for the U. S. and Mobile also fluctuated mildly during the year with the closing indexes for both 12 per cent above June 1950. The annual average indexes for 1952 for the U. S., Birmingham, and Mobile had the same percentage gains (2 per cent) over the averages for 1951 and all 3 indexes were record highs. Food prices (one of the heaviest weights in the index) in Birmingham dropped during the first quarter of '52 but climbed during the next 5 months to an all-time high in August. The Birmingham food index continued to fall during the rest of the year and the closing index was 0.8 per cent below that of a year ago. Food prices in Mobile rose steadily during the first 3 quarters of 1952, followed by a sharp drop of 2.6 per cent in the last quarter. Despite the fourth quarter decline, the annual average food index was 1.0 per cent above the annual index for '51. The food index for the U. S. started rising in March and continued to climb until August when a record index was reached. During the rest of the year, food prices in the nation receded and the closing index was below that of 1951. The above comparisons are based on the "interim adjusted" indexes on a 1935-39 base, and the indexes for December 1952 are the last in this series to be published. Beginning with January 1953, the "new revised index" will be on a 1947-49 base for the

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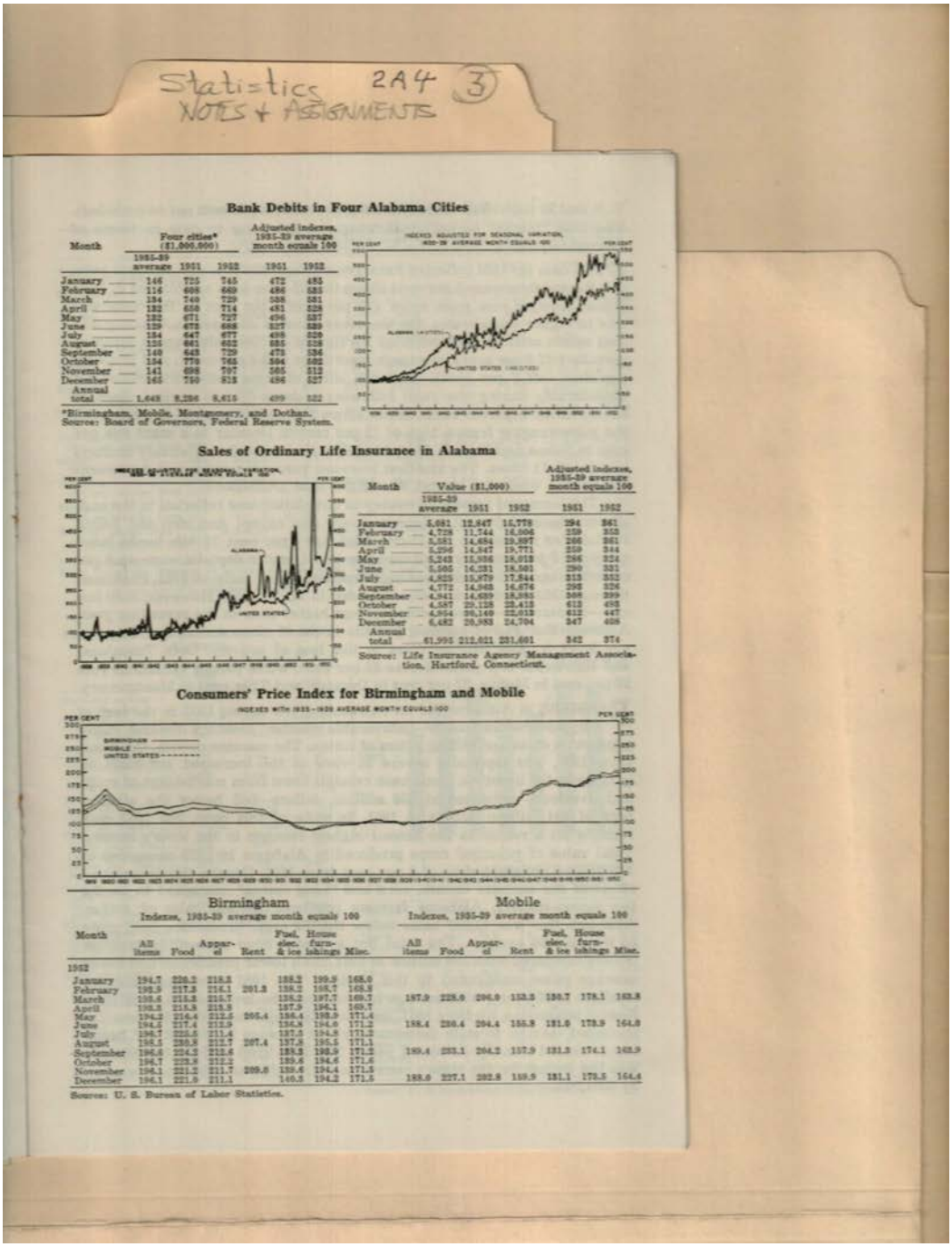

Names:

Business in Alabama

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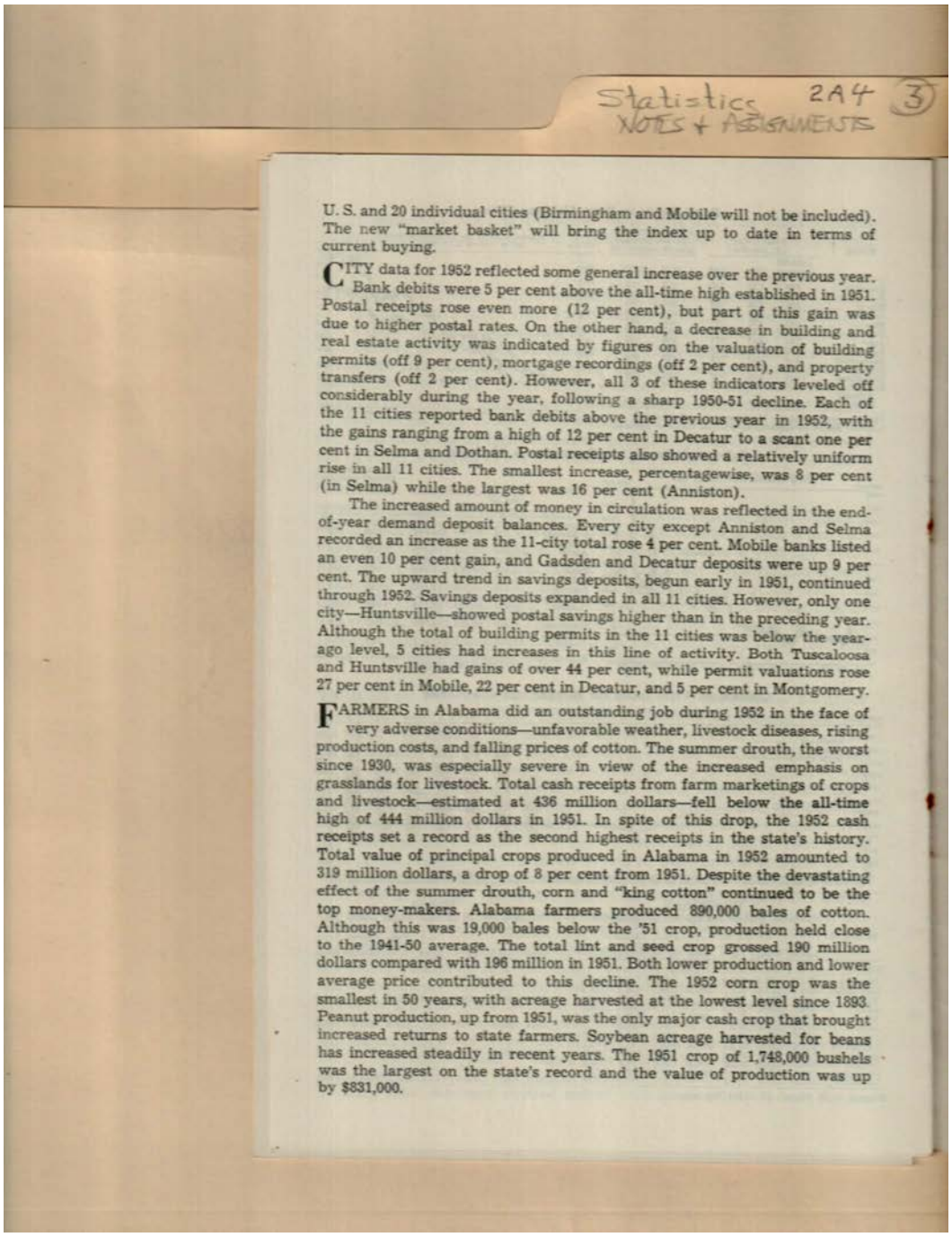

U. S. and 20 individual cities (Birmingham and Mobile will not be included). The new "market basket" will bring the index up to date in terms of current buying.

CITY data for 1952 reflected some general increase over the previous year. Bank debits were 5 per cent above the all-time high established in 1951. Postal receipts rose even more (12 per cent), but part of this gain was due to higher postal rates. On the other hand, a decrease in building and real estate activity was indicated by figures on the valuation of building permits (off 9 per cent), mortgage recordings (off 2 per cent), and property transfers (off 2 per cent). However, all 3 of these indicators leveled off considerably during the year, following a sharp 1950-51 decline. Each of the 11 cities reported bank debits above the previous year in 1952, with the gains ranging from a high of 12 per cent in Decatur to a scant one per cent in Selma and Dothan. Postal receipts also showed a relatively uniform rise in all 11 cities. The smallest increase, percentagewise, was 8 per cent (in Selma) while the largest was 16 per cent (Anniston).

The increased amount of money in circulation was reflected in the end-of-year demand deposit balances. Every city except Anniston and Selma recorded an increase as the 11-city total rose 4 per cent. Mobile banks listed an even 10 per cent gain, and Gadsden and Decatur deposits were up 9 per cent. The upward trend in savings deposits, begun early in 1951, continued through 1952. Savings deposits expanded in all 11 cities. However, only one city—Huntsville—showed postal savings higher than in the preceding year. Although the total of building permits in the 11 cities was below the year-ago level, 5 cities had increases in this line of activity. Both Tuscaloosa and Huntsville had gains of over 44 per cent, while permit valuations rose 27 per cent in Mobile, 22 per cent in Decatur, and 5 per cent in Montgomery.

FARMERS in Alabama did an outstanding job during 1952 in the face of very adverse conditions—unfavorable weather, livestock diseases, rising production costs, and falling prices of cotton. The summer drouth, the worst since 1930, was especially severe in view of the increased emphasis on grasslands for livestock. Total cash receipts from farm marketings of crops and livestock—estimated at 436 million dollars—fell below the all-time high of 444 million dollars in 1951. In spite of this drop, the 1952 cash receipts set a record as the second highest receipts in the state's history. Total value of principal crops produced in Alabama in 1952 amounted to 319 million dollars, a drop of 8 per cent from 1951. Despite the devastating effect of the summer drouth, corn and "king cotton" continued to be the top money-makers. Alabama farmers produced 890,000 bales of cotton. Although this was 19,000 bales below the '51 crop, production held close to the 1941-50 average. The total lint and seed crop grossed 190 million dollars compared with 196 million in 1951. Both lower production and lower average price contributed to this decline. The 1952 corn crop was the smallest in 50 years, with acreage harvested at the lowest level since 1893. Peanut production, up from 1951, was the only major cash crop that brought increased returns to state farmers. Soybean acreage harvested for beans has increased steadily in recent years. The 1951 crop of 1,748,000 bushels was the largest on the state's record and the value of production was up by $831,000.

Names:
Business in Alabama

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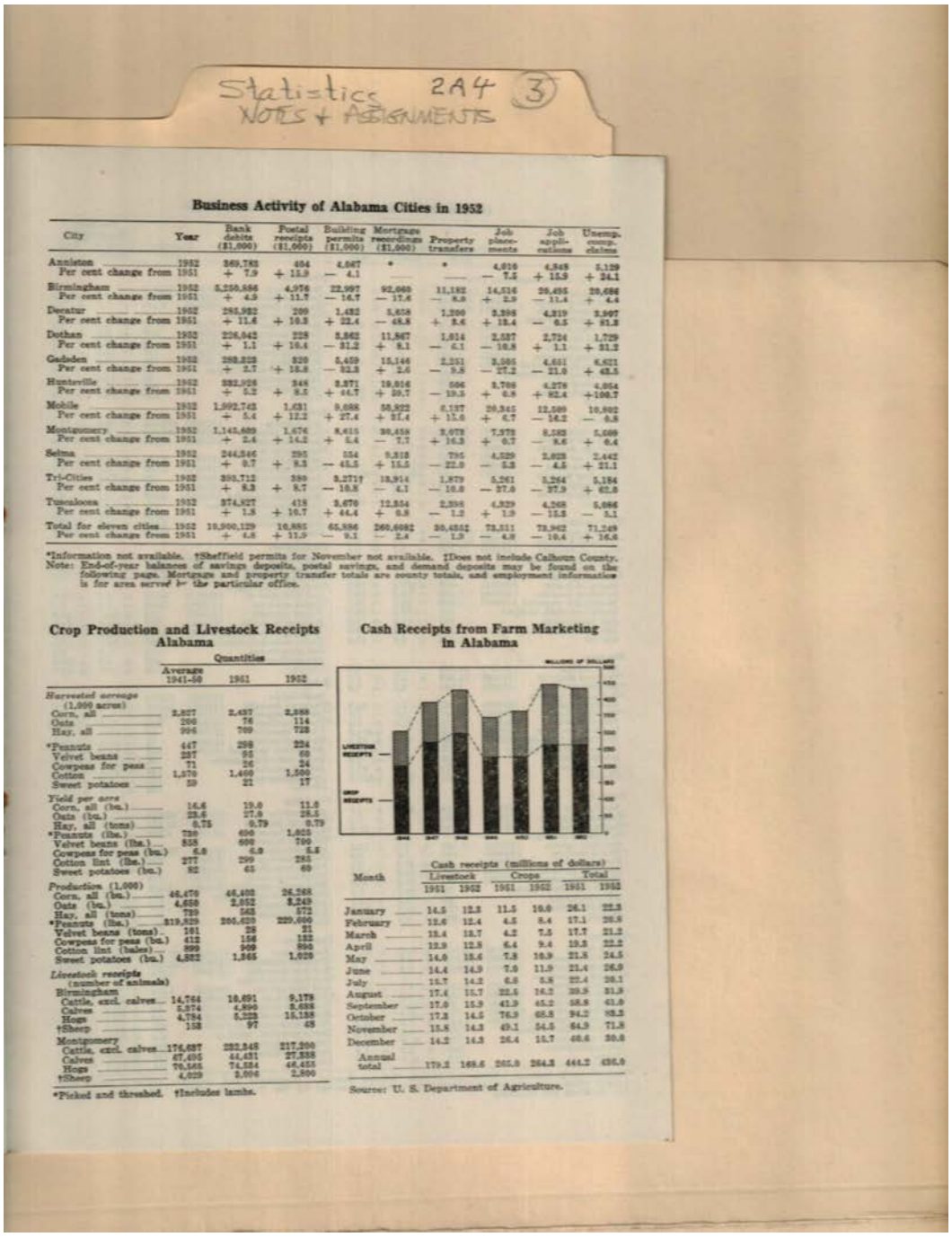

Business Activity of Alabama Cities in 1952

City	Year	Bank debits ($1,000)	Postal receipts ($1,000)	Building permits ($1,000)	Mortgage recordings ($1,000)	Property transfers	Job placements	Job applications	Unemp. comp. claims
Anniston	1952	369,783	404	4,067	*	*	4,010	4,849	5,129
Per cent change from	1951	+ 7.9	+ 13.9	— 4.1			— 7.5	+ 15.9	+ 24.1
Birmingham	1952	5,250,886	4,976	22,997	92,060	11,182	14,516	26,495	20,686
Per cent change from	1951	+ 4.9	+ 11.7	— 14.7	— 17.6	— 8.8	+ 2.9	— 11.4	+ 4.4
Decatur	1952	293,982	299	1,482	5,658	1,200	3,398	4,819	3,907
Per cent change from	1951	+ 11.6	+ 10.3	+ 22.4	— 48.8	+ 8.6	+ 18.4	— 6.5	+ 81.8
Dothan	1952	226,042	228	3,862	11,867	1,814	2,537	2,724	1,729
Per cent change from	1951	+ 1.1	+ 10.4	— 31.2	+ 8.1	— 6.1	— 10.8	+ 1.1	+ 31.2
Gadsden	1952	288,328	320	5,459	15,146	2,251	3,595	4,631	6,621
Per cent change from	1951	+ 2.7	+ 18.8	— 32.3	+ 2.6	— 9.8	— 27.2	— 21.0	+ 48.5
Huntsville	1952	532,926	548	3,371	19,016	506	3,708	4,276	4,054
Per cent change from	1951	+ 5.2	+ 8.5	+ 44.7	+ 10.7	— 19.3	+ 0.8	+ 82.4	+100.7
Mobile	1952	1,992,743	1,631	9,088	58,922	6,197	20,341	12,589	10,902
Per cent change from	1951	+ 5.4	+ 12.2	+ 27.4	+ 37.4	+ 15.6	+ 6.7	— 14.2	— 0.8
Montgomery	1952	1,143,689	1,676	8,415	30,459	3,073	7,573	8,582	5,089
Per cent change from	1951	+ 2.4	+ 14.2	+ 5.4	— 7.7	+ 16.3	+ 0.7	— 8.6	+ 0.4
Selma	1952	244,546	295	554	3,218	795	4,229	3,923	2,442
Per cent change from	1951	+ 0.7	+ 8.3	— 41.5	+ 15.5	— 22.9	— 5.3	— 4.5	+ 21.1
Tri-Cities	1952	393,712	390	2,771†	18,914	1,879	5,261	3,264	5,154
Per cent change from	1951	+ 8.3	+ 9.7	— 10.5	— 4.1	— 18.8	— 17.6	— 27.9	+ 67.6
Tuscaloosa	1952	374,827	418	2,670	12,554	2,396	4,329	4,268	5,066
Per cent change from	1951	+ 1.8	+ 10.7	+ 64.4	+ 6.8	— 1.2	+ 1.9	— 15.8	— 5.1
Total for eleven cities	1952	13,900,129	10,895	65,386	260,6082	30,4552	73,511	73,962	71,249
Per cent change from	1951	+ 4.8	+ 11.9	— 9.1	— 2.4	— 1.9	— 4.8	— 10.4	+ 16.6

*Information not available. †Sheffield permits for November not available. ‡Does not include Calhoun County.
Note: End-of-year balances of savings deposits, postal savings, and demand deposits may be found on the following page. Mortgage and property transfer totals are county totals, and employment information is for area served by the particular office.

Crop Production and Livestock Receipts Alabama

	Quantities		
	Average 1941-50	1951	1952
Harvested acreage (1,000 acres)			
Corn, all	2,827	2,437	2,888
Oats	200	76	114
Hay, all	904	709	728
*Peanuts	447	298	224
Velvet beans	237	95	60
Cowpeas for peas	71	26	24
Cotton	1,570	1,460	1,500
Sweet potatoes	59	21	17
Yield per acre			
Corn, all (bu.)	14.6	19.0	11.0
Oats (bu.)	23.6	17.0	26.5
Hay, all (tons)	0.75	0.79	0.79
*Peanuts (lbs.)	730	690	1,003
Velvet beans (lbs.)	855	600	700
Cowpeas for peas (bu.)	6.8	6.0	6.5
Cotton lint (lbs.)	277	299	285
Sweet potatoes (bu.)	82	61	69
Production (1,000)			
Corn, all (bu.)	46,470	46,403	26,568
Oats (bu.)	4,650	2,052	3,249
Hay, all (tons)	739	563	572
*Peanuts (lbs.)	319,529	205,620	229,000
Velvet beans (tons)	181	28	21
Cowpeas for peas (bu.)	412	156	132
Cotton lint (bales)	899	949	890
Sweet potatoes (bu.)	4,882	1,265	1,029
Livestock receipts (number of animals)			
Birmingham			
Cattle, excl. calves	14,764	10,691	9,178
Calves	5,374	4,800	5,038
Hogs	4,784	6,223	15,138
†Sheep	158	97	48
Montgomery			
Cattle, excl. calves	174,687	232,345	217,200
Calves	47,402	44,431	27,358
Hogs	76,165	74,534	46,455
†Sheep	4,029	2,004	2,800

*Picked and threshed. †Includes lambs.

Cash Receipts from Farm Marketing in Alabama

Month	Cash receipts (millions of dollars) Livestock 1951	Livestock 1952	Crops 1951	Crops 1952	Total 1951	Total 1952
January	14.5	12.3	11.5	10.0	26.1	22.3
February	12.6	12.4	4.5	5.4	17.1	16.8
March	13.4	13.7	4.2	7.5	17.7	21.2
April	12.9	12.3	6.4	9.4	19.3	22.2
May	14.0	13.6	7.9	10.9	21.8	24.5
June	14.4	14.9	7.0	11.9	21.4	26.9
July	15.7	14.2	6.8	9.8	22.4	24.1
August	17.4	15.7	22.5	16.2	39.9	31.9
September	17.0	15.9	41.9	45.2	58.8	61.0
October	17.3	14.5	76.9	68.8	94.2	83.3
November	15.8	14.3	49.1	54.5	64.9	71.8
December	14.2	14.3	26.4	15.7	40.6	30.0
Annual total	179.2	168.6	265.9	264.8	444.2	436.0

Source: U. S. Department of Agriculture.

Names:
Business in Alabama

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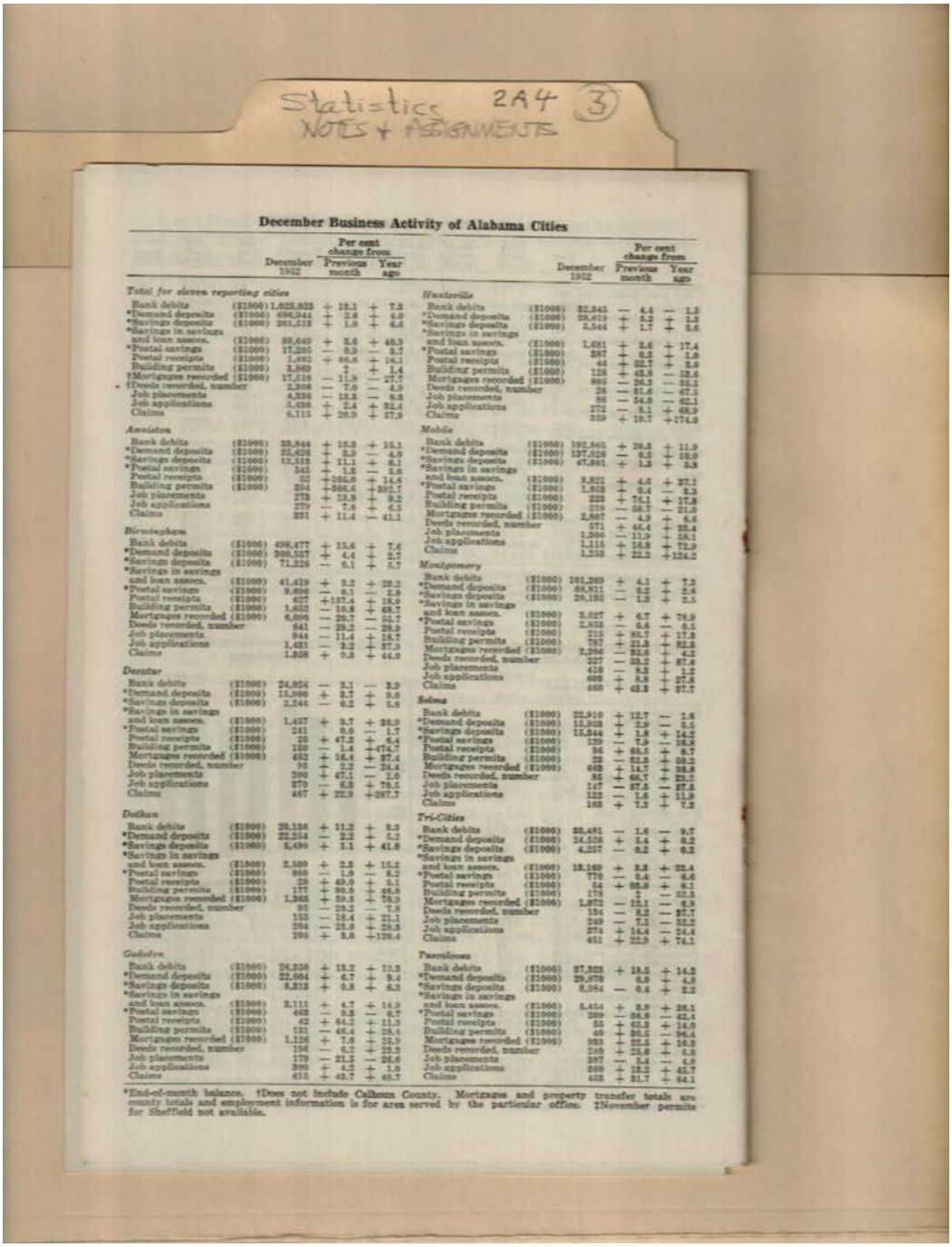

December Business Activity of Alabama Cities

		December 1952	Per cent change from Previous month	Per cent change from Year ago
Total for eleven reporting cities				
Bank debits	($1000)	1,025,823	+ 18.1	+ 7.3
*Demand deposits	($1000)	686,944	+ 2.6	+ 4.0
*Savings deposits	($1000)	261,519	+ 1.0	+ 6.6
*Savings in savings and loan assocs.	($1000)	93,643	+ 3.6	+ 40.9
*Postal savings	($1000)	17,295	— 0.9	— 3.7
Postal receipts	($1000)	1,491	+ 66.6	+ 16.1
Building permits	($1000)	2,969	†	+ 1.4
†Mortgages recorded	($1000)	17,518	— 11.8	— 27.7
†Deeds recorded, number		2,308	— 7.0	— 4.9
Job placements		4,336	— 18.8	— 9.3
Job applications		5,430	+ 2.4	+ 32.4
Claims		6,115	+ 20.9	+ 57.9
Anniston				
Bank debits	($1000)	33,944	+ 15.8	+ 15.1
*Demand deposits	($1000)	25,626	+ 8.0	— 4.0
*Savings deposits	($1000)	12,515	+ 11.1	+ 8.1
*Postal savings	($1000)	545	+ 1.3	— 5.0
Postal receipts	($1000)	52	+105.0	+ 14.4
Building permits	($1000)	304	+366.6	+392.7
Job placements		273	+ 13.8	+ 9.2
Job applications		279	+ 7.6	+ 6.5
Claims		331	+ 11.4	— 41.1
Birmingham				
Bank debits	($1000)	498,477	+ 15.6	+ 7.6
*Demand deposits	($1000)	300,537	+ 4.4	+ 2.7
*Savings deposits	($1000)	71,326	— 0.1	+ 5.7
*Savings in savings and loan assocs.	($1000)	41,419	+ 3.2	+ 28.2
*Postal savings	($1000)	9,696	— 0.1	— 2.8
Postal receipts	($1000)	627	+107.4	+ 18.9
Building permits	($1000)	1,402	— 10.8	+ 68.7
Mortgages recorded	($1000)	6,096	— 20.7	— 34.7
Deeds recorded, number		641	— 29.2	— 28.9
Job placements		944	— 11.4	+ 18.7
Job applications		1,431	— 2.2	+ 37.3
Claims		1,858	+ 9.8	+ 44.0
Decatur				
Bank debits	($1000)	24,824	— 3.1	— 3.9
*Demand deposits	($1000)	15,900	+ 3.7	+ 3.0
*Savings deposits	($1000)	2,244	— 0.2	+ 5.8
*Savings in savings and loan assocs.	($1000)	1,497	+ 3.7	+ 30.9
*Postal savings	($1000)	241	0.0	— 1.7
Postal receipts	($1000)	25	+ 47.2	+ 6.4
Building permits	($1000)	120	— 1.4	+171.7
Mortgages recorded	($1000)	452	+ 16.4	+ 37.4
Deeds recorded, number		90	+ 2.2	— 24.4
Job placements		200	+ 47.1	— 2.0
Job applications		270	— 6.3	+ 78.5
Claims		467	+ 22.9	+267.7
Dothan				
Bank debits	($1000)	20,134	+ 11.2	+ 3.3
*Demand deposits	($1000)	22,514	— 2.2	+ 5.2
*Savings deposits	($1000)	3,499	+ 3.1	+ 41.8
*Savings in savings and loan assocs.	($1000)	2,520	+ 2.8	+ 15.2
*Postal savings	($1000)	800	— 1.0	— 8.2
Postal receipts	($1000)	28	+ 40.0	+ 5.1
Building permits	($1000)	177	+ 80.0	+ 46.8
Mortgages recorded	($1000)	1,365	+ 59.1	+ 70.3
Deeds recorded, number		95	— 20.2	— 7.8
Job placements		155	— 19.4	+ 21.1
Job applications		204	— 23.0	+ 28.8
Claims		286	+ 8.0	+128.4
Gadsden				
Bank debits	($1000)	26,558	+ 13.2	+ 12.3
*Demand deposits	($1000)	22,094	+ 6.7	+ 9.4
*Savings deposits	($1000)	8,218	+ 0.8	+ 6.3
*Savings in savings and loan assocs.	($1000)	3,111	+ 4.7	+ 14.9
*Postal savings	($1000)	468	— 0.2	— 8.7
Postal receipts	($1000)	42	+ 64.2	+ 11.5
Building permits	($1000)	151	— 46.4	+ 28.4
Mortgages recorded	($1000)	1,126	+ 7.0	+ 25.9
Deeds recorded, number		196	— 6.1	+ 23.5
Job placements		179	— 21.5	— 26.6
Job applications		300	+ 4.2	+ 1.0
Claims		615	+ 43.7	+ 40.7
Huntsville				
Bank debits	($1000)	82,845	— 4.4	— 1.5
*Demand deposits	($1000)	58,619	+ 5.2	+ 1.3
*Savings deposits	($1000)	8,544	+ 1.7	+ 5.6
*Savings in savings and loan assocs.	($1000)	1,491	+ 5.6	+ 17.4
*Postal savings	($1000)	287	0.0	+ 1.0
Postal receipts	($1000)	44	+ 22.7	+ 5.0
Building permits	($1000)	128	+ 43.6	— 32.6
Mortgages recorded	($1000)	805	— 26.3	— 35.1
Deeds recorded, number		26	— 51.6	— 47.1
Job placements		86	— 54.0	— 62.1
Job applications		272	— 8.1	+ 68.9
Claims		359	+ 19.7	+174.0
Mobile				
Bank debits	($1000)	192,861	+ 20.5	+ 11.9
*Demand deposits	($1000)	137,528	— 0.5	+ 10.0
*Savings deposits	($1000)	47,981	+ 1.3	+ 5.8
*Savings in savings and loan assocs.	($1000)	9,821	+ 4.6	+ 37.1
*Postal savings	($1000)	1,958	+ 0.4	— 3.3
Postal receipts	($1000)	228	+ 74.1	+ 17.8
Building permits	($1000)	219	— 58.7	— 21.0
Mortgages recorded	($1000)	2,907	— 4.9	+ 6.4
Deeds recorded, number		371	+ 46.4	+ 33.4
Job placements		1,206	— 11.9	+ 38.1
Job applications		1,115	+ 16.8	+ 72.9
Claims		1,258	+ 22.2	+124.2
Montgomery				
Bank debits	($1000)	101,260	+ 4.1	+ 7.3
*Demand deposits	($1000)	68,811	— 0.2	+ 2.6
*Savings deposits	($1000)	20,195	— 1.3	+ 2.1
*Savings in savings and loan assocs.	($1000)	5,027	+ 6.7	+ 78.9
*Postal savings	($1000)	2,833	— 0.6	— 0.1
Postal receipts	($1000)	213	+ 35.7	+ 17.3
Building permits	($1000)	787	+ 21.3	+ 82.5
Mortgages recorded	($1000)	2,264	— 32.6	+ 4.2
Deeds recorded, number		227	— 33.1	+ 37.6
Job placements		418	— 8.3	+ 1.2
Job applications		603	+ 3.5	+ 27.8
Claims		460	+ 43.3	+ 37.7
Selma				
Bank debits	($1000)	22,910	+ 12.7	— 1.6
*Demand deposits	($1000)	12,302	+ 2.9	— 5.1
*Savings deposits	($1000)	12,344	+ 1.8	+ 14.2
*Postal savings	($1000)	129	— 7.9	— 16.5
Postal receipts	($1000)	24	+ 65.5	+ 9.7
Building permits	($1000)	22	— 52.5	+ 69.2
Mortgages recorded	($1000)	662	+ 14.7	+ 38.9
Deeds recorded, number		83	+ 66.7	+ 22.1
Job placements		147	+ 87.5	+ 87.5
Job applications		122	— 1.6	+ 11.9
Claims		163	+ 7.2	+ 7.2
Tri-Cities				
Bank debits	($1000)	33,451	— 1.6	— 9.7
*Demand deposits	($1000)	24,536	+ 5.4	+ 6.2
*Savings deposits	($1000)	4,257	— 0.2	+ 6.2
*Savings in savings and loan assocs.	($1000)	18,169	+ 3.3	+ 22.4
*Postal savings	($1000)	770	— 0.4	— 6.6
Postal receipts	($1000)	54	+ 80.0	+ 8.1
Building permits	($1000)	178	†	— 52.3
Mortgages recorded	($1000)	1,073	— 12.1	— 8.9
Deeds recorded, number		134	— 8.2	— 27.7
Job placements		249	— 7.1	— 32.2
Job applications		374	+ 14.4	— 24.4
Claims		451	+ 22.9	+ 74.1
Tuscaloosa				
Bank debits	($1000)	37,325	+ 18.5	+ 14.2
*Demand deposits	($1000)	29,979	0.0	+ 4.3
*Savings deposits	($1000)	5,584	— 0.4	+ 2.2
*Savings in savings and loan assocs.	($1000)	5,454	+ 2.9	+ 26.1
*Postal savings	($1000)	399	— 24.5	— 42.1
Postal receipts	($1000)	53	+ 65.5	+ 14.0
Building permits	($1000)	46	+ 30.5	— 96.4
Mortgages recorded	($1000)	983	+ 22.6	+ 10.3
Deeds recorded, number		246	+ 23.0	+ 5.8
Job placements		357	— 5.4	— 4.0
Job applications		569	+ 18.3	+ 45.7
Claims		453	+ 21.7	+ 64.1

*End-of-month balance. †Does not include Calhoun County. Mortgage and property transfer totals are county totals and employment information is for area served by the particular office. ‡November permits for Sheffield not available.

Names:
Business in Alabama

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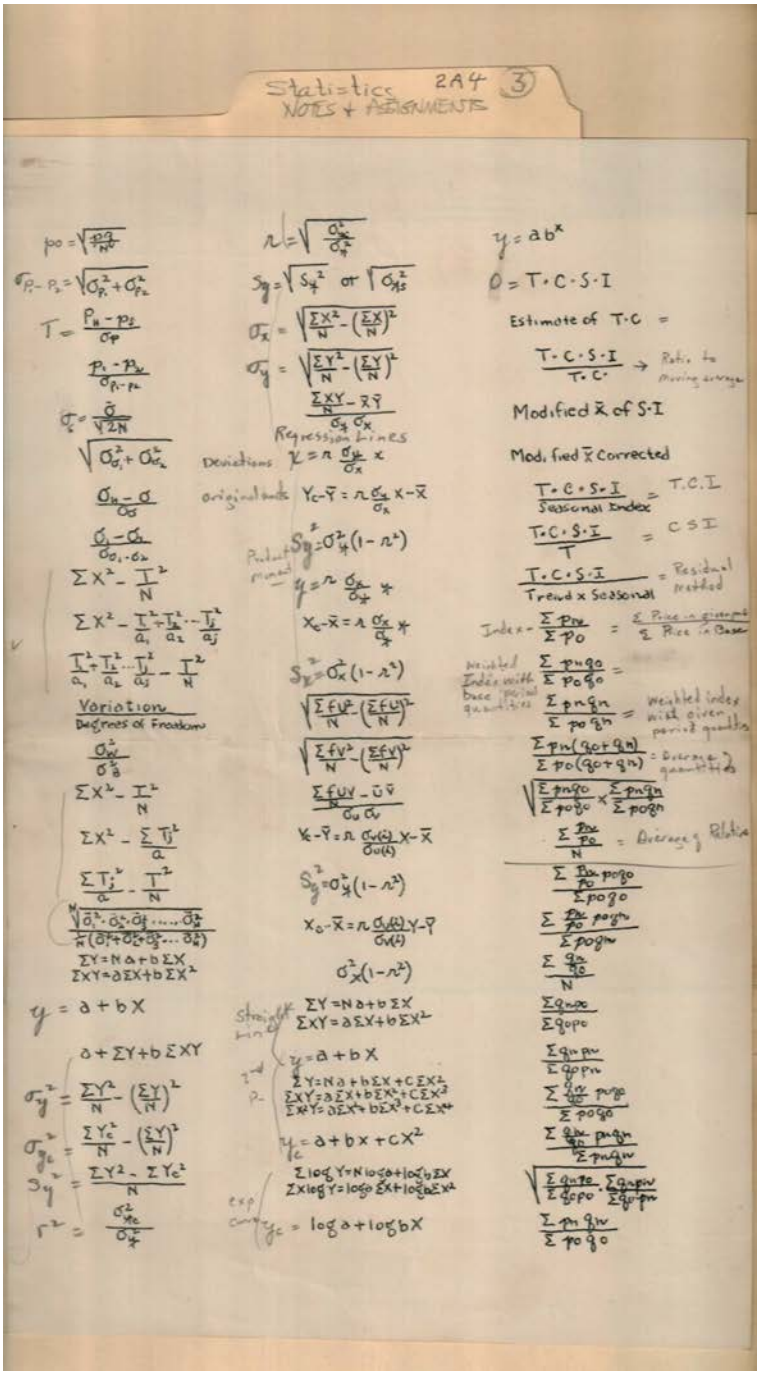

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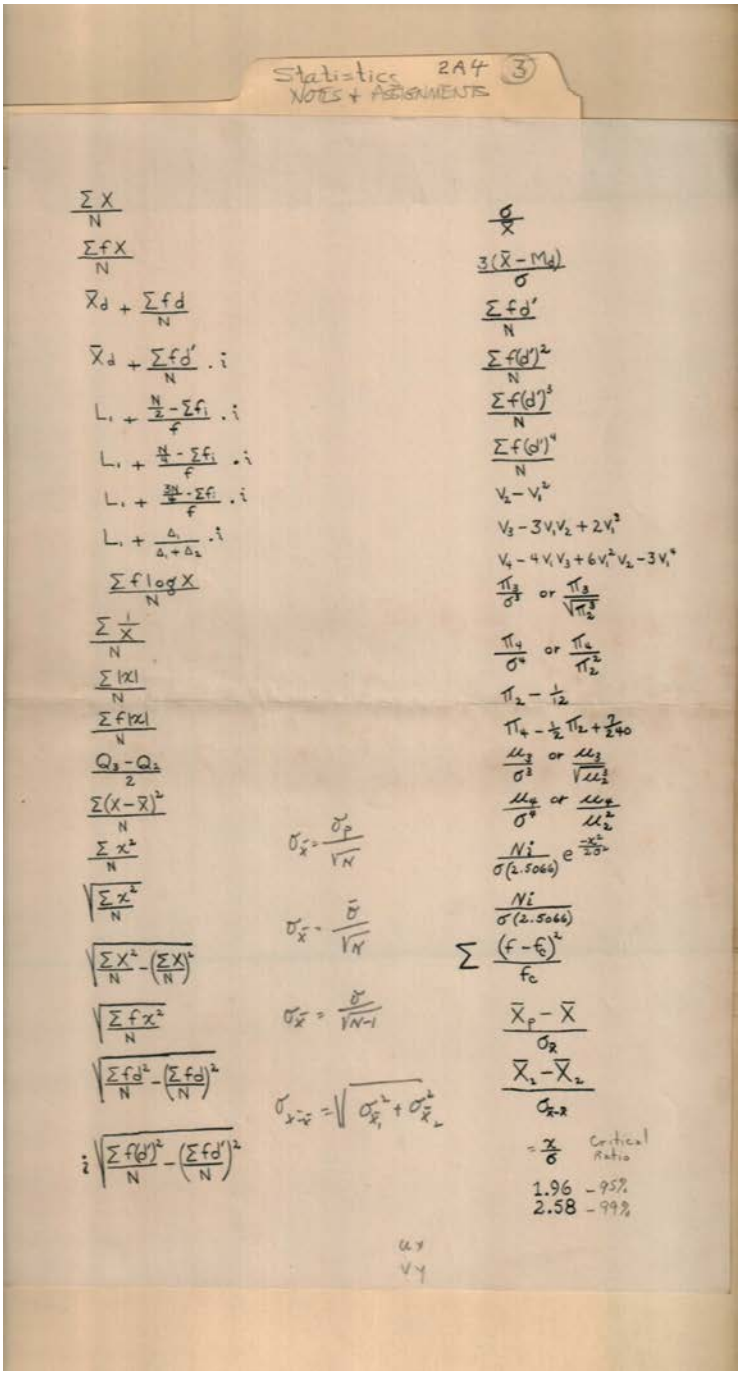

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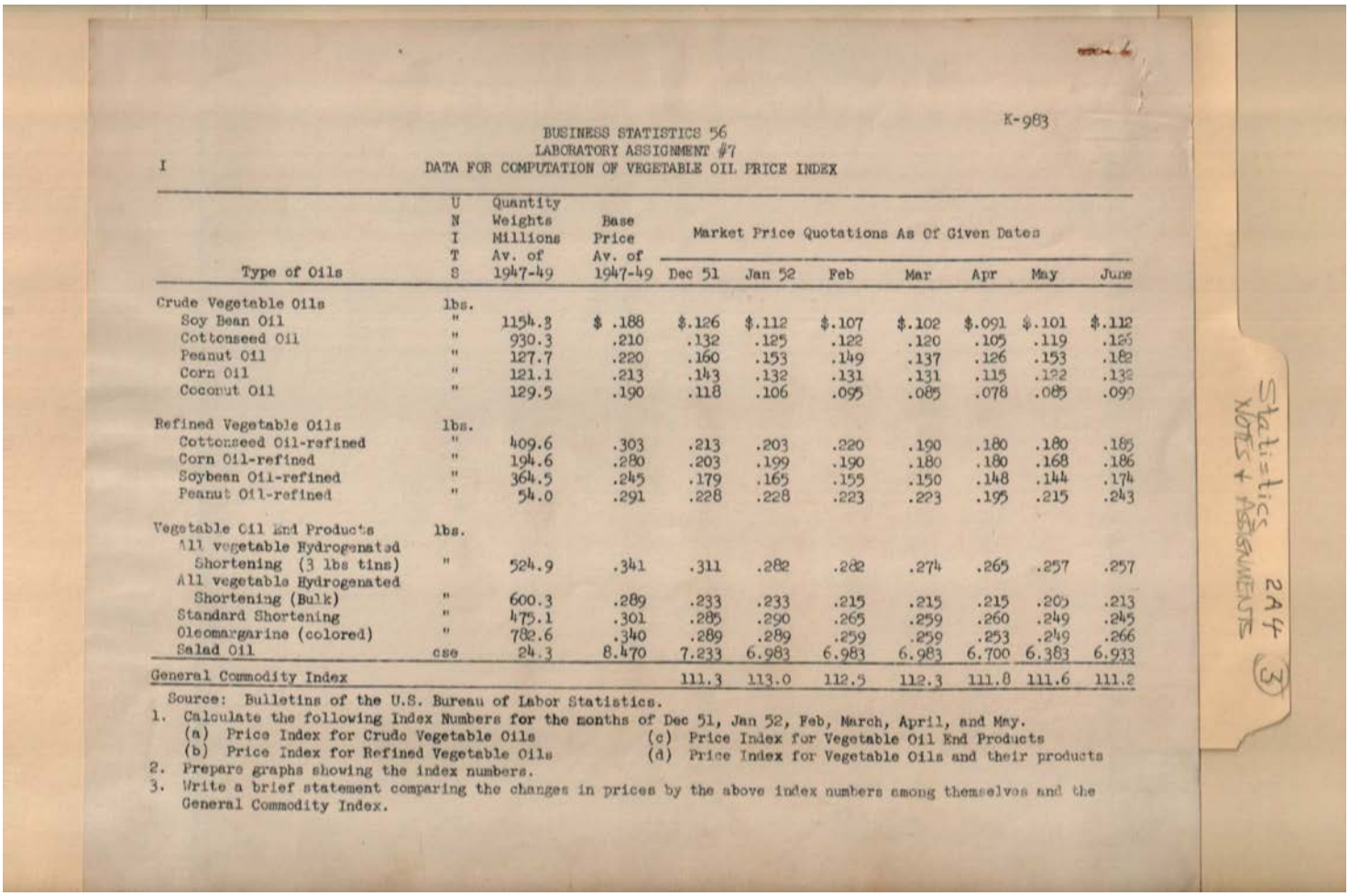


K-983

BUSINESS STATISTICS 56
LABORATORY ASSIGNMENT #7
DATA FOR COMPUTATION OF VEGETABLE OIL PRICE INDEX

I

Type of Oils	UNITS	Quantity Weights Millions Av. of 1947-49	Base Price Av. of 1947-49	Market Price Quotations As Of Given Dates						
				Dec 51	Jan 52	Feb	Mar	Apr	May	June
Crude Vegetable Oils	lbs.									
Soy Bean Oil	"	1154.3	$ .188	$.126	$.112	$.107	$.102	$.091	$.101	$.112
Cottonseed Oil	"	930.3	.210	.132	.125	.122	.120	.105	.119	.126
Peanut Oil	"	127.7	.220	.160	.153	.149	.137	.126	.153	.182
Corn Oil	"	121.1	.213	.143	.132	.131	.131	.115	.122	.132
Coconut Oil	"	129.5	.190	.118	.106	.095	.085	.078	.085	.099
Refined Vegetable Oils	lbs.									
Cottonseed Oil-refined	"	409.6	.303	.213	.203	.220	.190	.180	.180	.185
Corn Oil-refined	"	194.6	.280	.203	.199	.190	.180	.180	.168	.186
Soybean Oil-refined	"	364.5	.245	.179	.165	.155	.150	.148	.144	.174
Peanut Oil-refined	"	54.0	.291	.228	.228	.223	.223	.195	.215	.243
Vegetable Oil End Products	lbs.									
All vegetable Hydrogenated Shortening (3 lbs tins)	"	524.9	.341	.311	.282	.282	.274	.265	.257	.257
All vegetable Hydrogenated Shortening (Bulk)	"	600.3	.289	.233	.233	.215	.215	.215	.209	.213
Standard Shortening	"	475.1	.301	.285	.290	.265	.259	.260	.249	.245
Oleomargarine (colored)	"	782.6	.340	.289	.289	.259	.259	.253	.249	.266
Salad Oil	cse	24.3	8.470	7.233	6.983	6.983	6.983	6.700	6.383	6.933
General Commodity Index				111.3	113.0	112.5	112.3	111.8	111.6	111.2

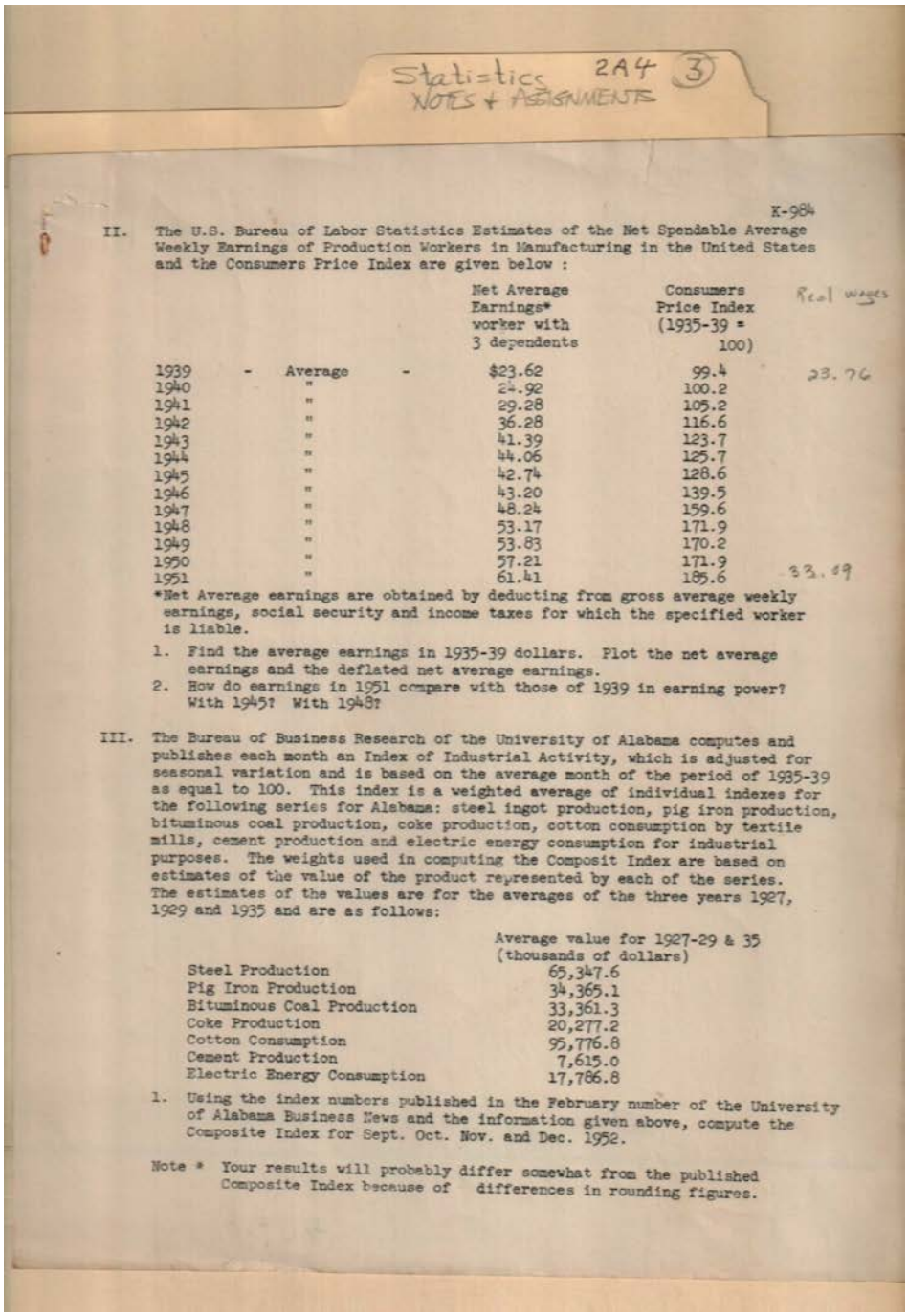
Source: Bulletins of the U.S. Bureau of Labor Statistics.

1. Calculate the following Index Numbers for the months of Dec 51, Jan 52, Feb, March, April, and May.
   (a) Price Index for Crude Vegetable Oils
   (b) Price Index for Refined Vegetable Oils
   (c) Price Index for Vegetable Oil End Products
   (d) Price Index for Vegetable Oils and their products
2. Prepare graphs showing the index numbers.
3. Write a brief statement comparing the changes in prices by the above index numbers among themselves and the General Commodity Index.

Statistics NOTES + ASSIGNMENTS 244 (3)

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-984

II. The U.S. Bureau of Labor Statistics Estimates of the Net Spendable Average Weekly Earnings of Production Workers in Manufacturing in the United States and the Consumers Price Index are given below :

		Net Average Earnings* worker with 3 dependents	Consumers Price Index (1935-39 = 100)	Real wages
1939	Average	$23.62	99.4	23.76
1940	"	24.92	100.2	
1941	"	29.28	105.2	
1942	"	36.28	116.6	
1943	"	41.39	123.7	
1944	"	44.06	125.7	
1945	"	42.74	128.6	
1946	"	43.20	139.5	
1947	"	48.24	159.6	
1948	"	53.17	171.9	
1949	"	53.83	170.2	
1950	"	57.21	171.9	
1951	"	61.41	185.6	33.09

*Net Average earnings are obtained by deducting from gross average weekly earnings, social security and income taxes for which the specified worker is liable.

1. Find the average earnings in 1935-39 dollars. Plot the net average earnings and the deflated net average earnings.
2. How do earnings in 1951 compare with those of 1939 in earning power? With 1945? With 1948?

III. The Bureau of Business Research of the University of Alabama computes and publishes each month an Index of Industrial Activity, which is adjusted for seasonal variation and is based on the average month of the period of 1935-39 as equal to 100. This index is a weighted average of individual indexes for the following series for Alabama: steel ingot production, pig iron production, bituminous coal production, coke production, cotton consumption by textile mills, cement production and electric energy consumption for industrial purposes. The weights used in computing the Composit Index are based on estimates of the value of the product represented by each of the series. The estimates of the values are for the averages of the three years 1927, 1929 and 1935 and are as follows:

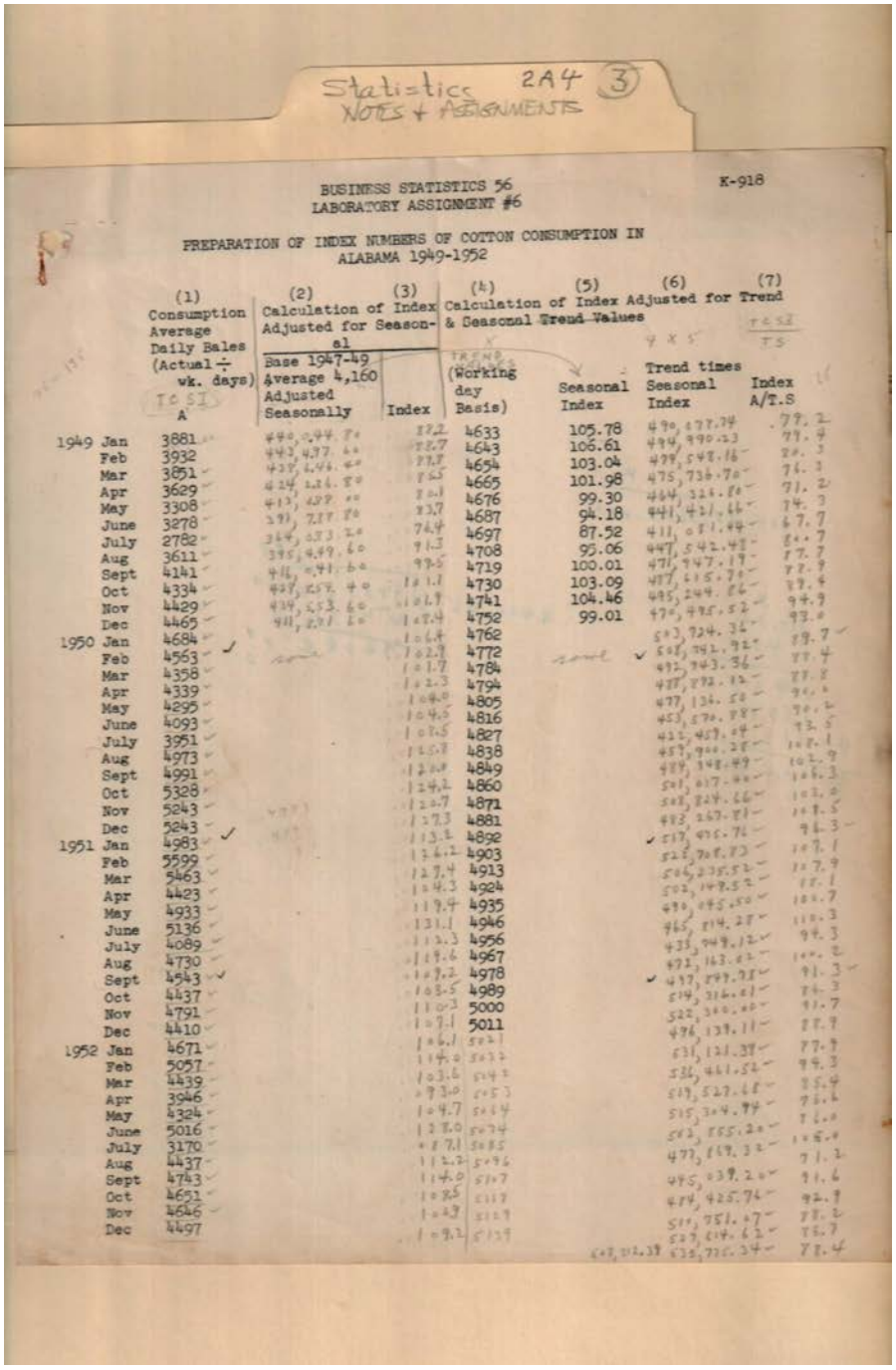
	Average value for 1927-29 & 35 (thousands of dollars)
Steel Production	65,347.6
Pig Iron Production	34,365.1
Bituminous Coal Production	33,361.3
Coke Production	20,277.2
Cotton Consumption	95,776.8
Cement Production	7,615.0
Electric Energy Consumption	17,786.8

1. Using the index numbers published in the February number of the University of Alabama Business News and the information given above, compute the Composite Index for Sept. Oct. Nov. and Dec. 1952.

Note * Your results will probably differ somewhat from the published Composite Index because of differences in rounding figures.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

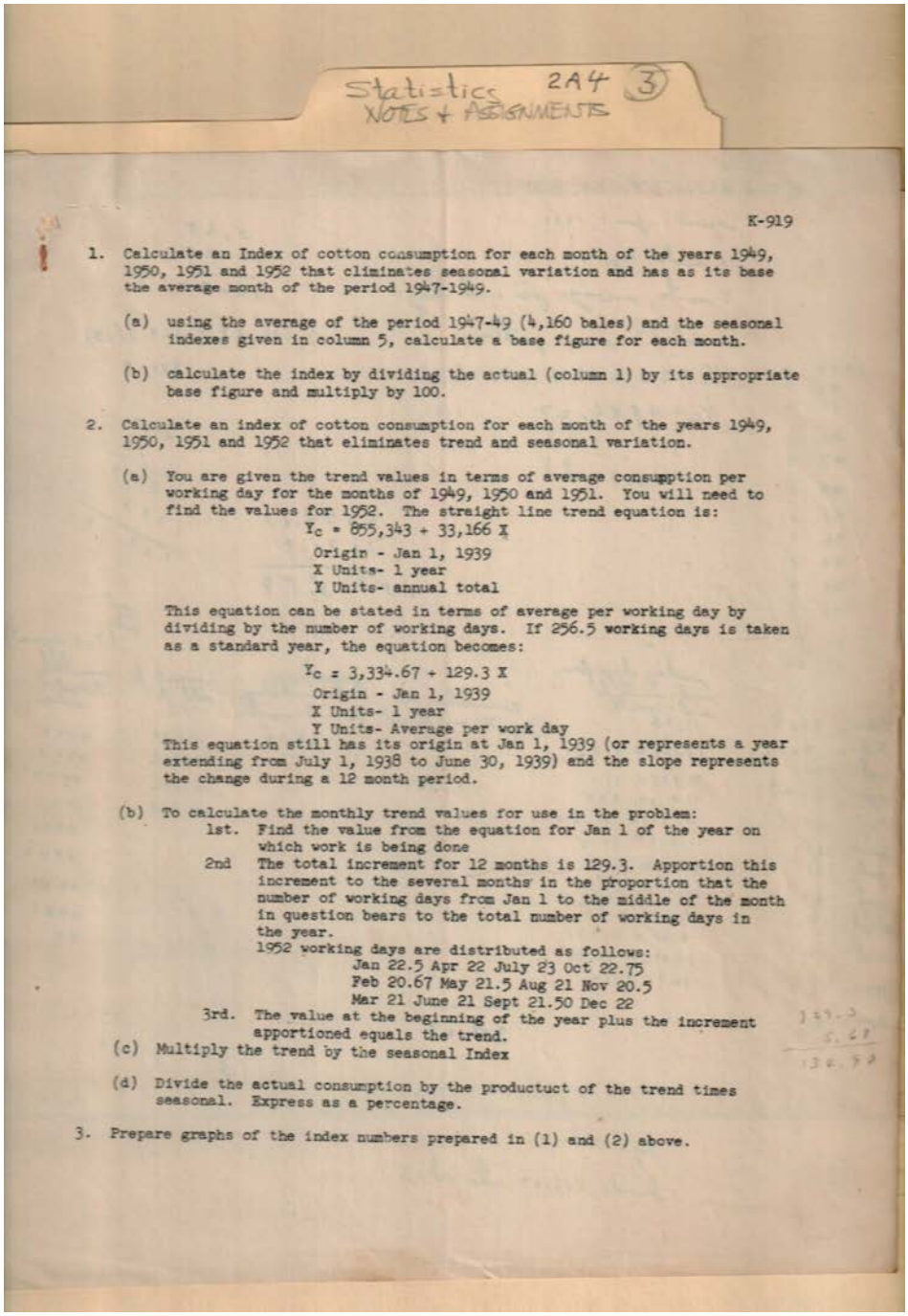
BUSINESS STATISTICS 56 K-918
LABORATORY ASSIGNMENT #6

PREPARATION OF INDEX NUMBERS OF COTTON CONSUMPTION IN ALABAMA 1949-1952

		(1) Consumption Average Daily Bales (Actual ÷ wk. days) A	(2) Calculation of Index Adjusted for Seasonal Base 1947-49 Average 4,160 Adjusted Seasonally	(3) Index	(4) Calculation of Index & Seasonal Trend Values (Working day Basis)	(5) Seasonal Index	(6) Adjusted for Trend Trend times Seasonal Index	(7) Index A/T.S
1949	Jan	3881			4633	105.78		
	Feb	3932			4643	106.61		
	Mar	3851			4654	103.04		
	Apr	3629			4665	101.98		
	May	3308			4676	99.30		
	June	3278			4687	94.18		
	July	2782			4697	87.52		
	Aug	3611			4708	95.06		
	Sept	4141			4719	100.01		
	Oct	4334			4730	103.09		
	Nov	4429			4741	104.46		
	Dec	4465			4752	99.01		
1950	Jan	4684			4762			
	Feb	4563			4772			
	Mar	4358			4784			
	Apr	4339			4794			
	May	4295			4805			
	June	4093			4816			
	July	3951			4827			
	Aug	4973			4838			
	Sept	4991			4849			
	Oct	5328			4860			
	Nov	5243			4871			
	Dec	5243			4881			
1951	Jan	4983			4892			
	Feb	5599			4903			
	Mar	5463			4913			
	Apr	4423			4924			
	May	4933			4935			
	June	5136			4946			
	July	4089			4956			
	Aug	4730			4967			
	Sept	4543			4978			
	Oct	4437			4989			
	Nov	4791			5000			
	Dec	4410			5011			
1952	Jan	4671						
	Feb	5057						
	Mar	4439						
	Apr	3946						
	May	4324						
	June	5016						
	July	3170						
	Aug	4437						
	Sept	4743						
	Oct	4651						
	Nov	4646						
	Dec	4497						

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-919

1. Calculate an Index of cotton consumption for each month of the years 1949, 1950, 1951 and 1952 that eliminates seasonal variation and has as its base the average month of the period 1947-1949.

   (a) using the average of the period 1947-49 (4,160 bales) and the seasonal indexes given in column 5, calculate a base figure for each month.

   (b) calculate the index by dividing the actual (column 1) by its appropriate base figure and multiply by 100.

2. Calculate an index of cotton consumption for each month of the years 1949, 1950, 1951 and 1952 that eliminates trend and seasonal variation.

   (a) You are given the trend values in terms of average consumption per working day for the months of 1949, 1950 and 1951. You will need to find the values for 1952. The straight line trend equation is:

   $$Y_c = 855,343 + 33,166\ X$$

   Origin - Jan 1, 1939
   X Units- 1 year
   Y Units- annual total

   This equation can be stated in terms of average per working day by dividing by the number of working days. If 256.5 working days is taken as a standard year, the equation becomes:

   $$Y_c = 3,334.67 + 129.3\ X$$

   Origin - Jan 1, 1939
   X Units- 1 year
   Y Units- Average per work day

   This equation still has its origin at Jan 1, 1939 (or represents a year extending from July 1, 1938 to June 30, 1939) and the slope represents the change during a 12 month period.

   (b) To calculate the monthly trend values for use in the problem:
   1st. Find the value from the equation for Jan 1 of the year on which work is being done
   2nd The total increment for 12 months is 129.3. Apportion this increment to the several months in the proportion that the number of working days from Jan 1 to the middle of the month in question bears to the total number of working days in the year.
   1952 working days are distributed as follows:
   Jan 22.5 Apr 22 July 23 Oct 22.75
   Feb 20.67 May 21.5 Aug 21 Nov 20.5
   Mar 21 June 21 Sept 21.50 Dec 22
   3rd. The value at the beginning of the year plus the increment apportioned equals the trend.

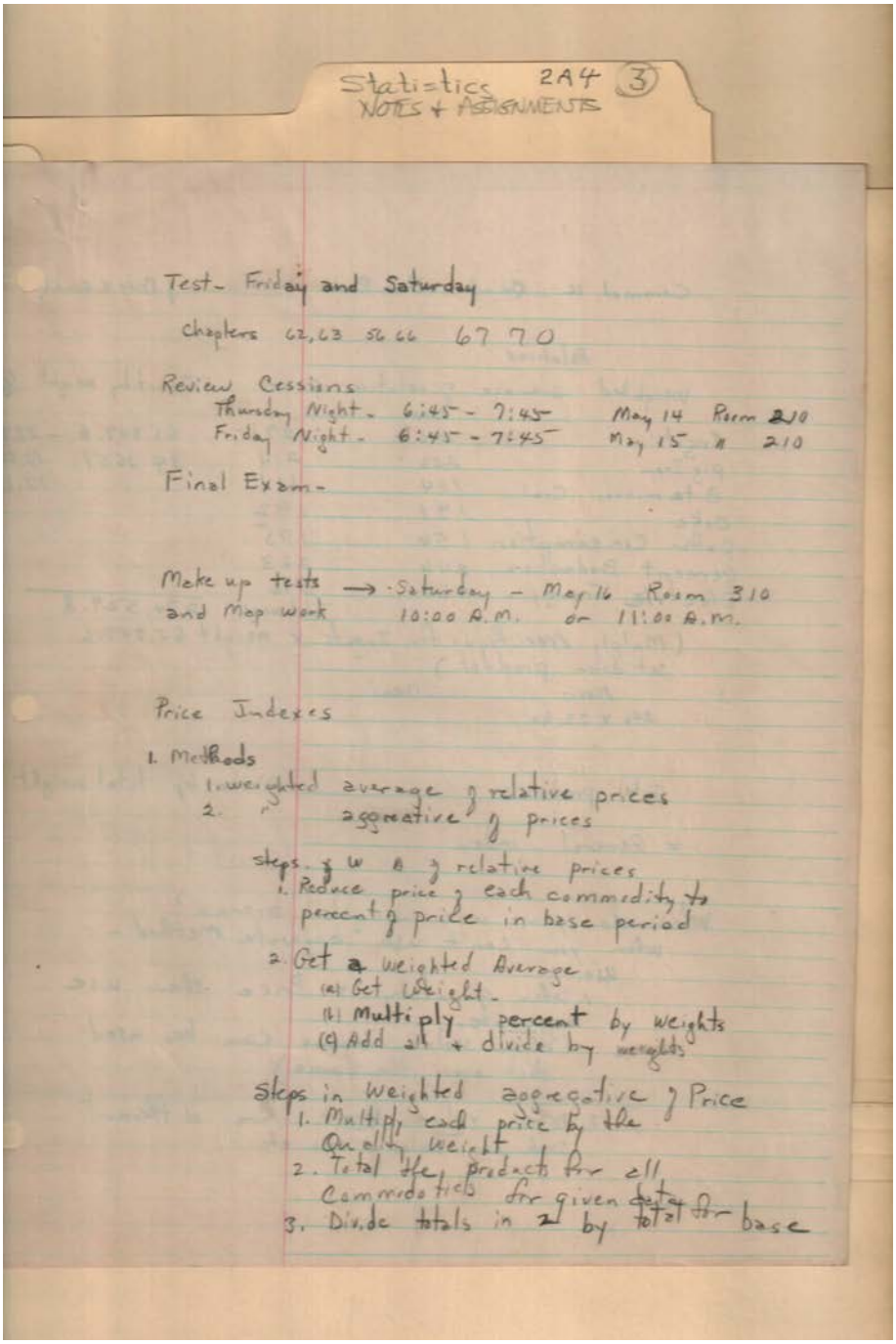
   (c) Multiply the trend by the seasonal Index

   (d) Divide the actual consumption by the productuct of the trend times seasonal. Express as a percentage.

3. Prepare graphs of the index numbers prepared in (1) and (2) above.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Test- Friday and Saturday

Chapters 62, 63 56 66 67 70

Review Sessions
Thursday Night - 6:45 - 7:45 May 14 Room 210
Friday Night - 6:45 - 7:45 May 15 " 210

Final Exam -

Make up tests → Saturday - May 16 Room 310
and Map work 10:00 A.M. or 11:00 A.M.

Price Indexes

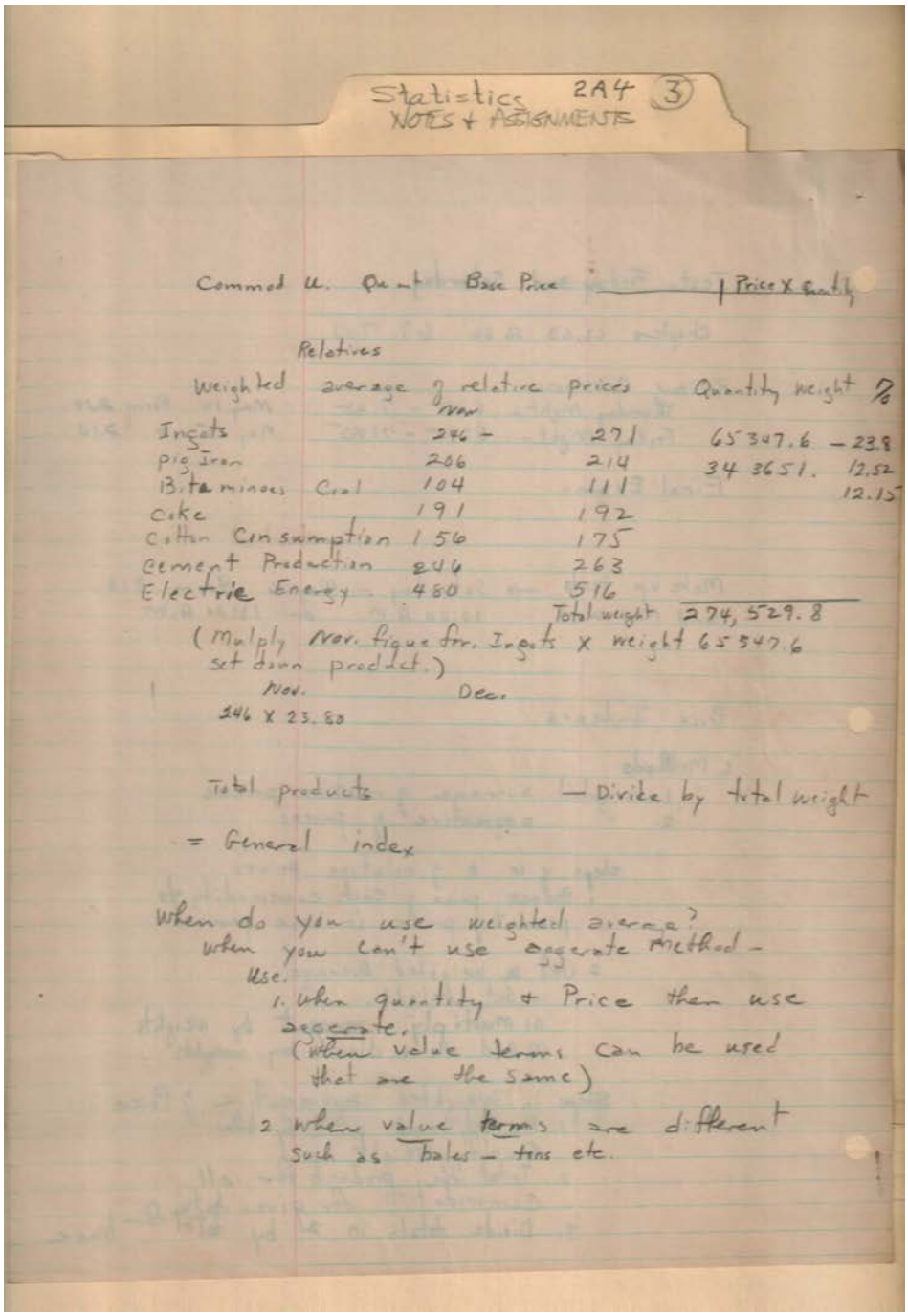
1. Methods
1. weighted average of relative prices
2. " aggregative of prices

steps of W A of relative prices
1. Reduce price of each commodity to percent of price in base period
2. Get a weighted Average
(a) Get Weight.
(b) Multiply percent by weights
(c) Add all + divide by weights

Steps in weighted aggregative of Price
1. Multiply each price by the Quality weight
2. Total the products for all Commodities for given date for base
3. Divide totals in 2 by total for base

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Commod u. Quant Base Price | Price x Quant

Relatives

Weighted average of relative prices Quantity weight %

	Nov			
Ingots	246 -	271	65347.6	-23.8
pig Iron	206	214	34 3651.	12.52
Bituminous Coal	104	111		12.15
Coke	191	192		
Cotton Consumption	156	175		
Cement Production	246	263		
Electric Energy	480	516		

Total weight 274,529.8

(Multiply Nov. figure for Ingots x weight 65547.6
set down product.)

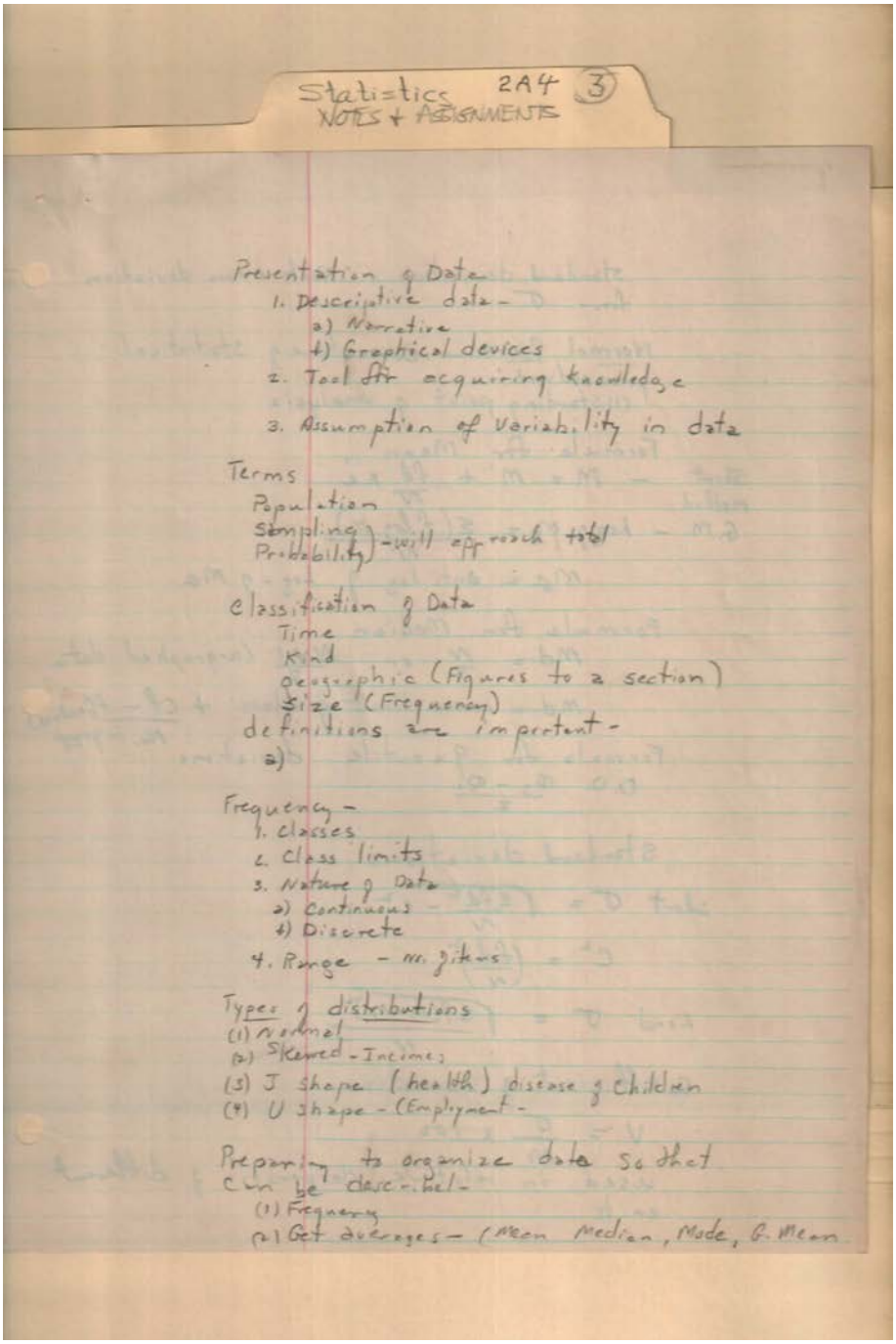
Nov. Dec.
246 X 23.80

Total products — Divide by total weight
= General index

When do you use weighted average?
When you can't use aggregate method -
Use.
1. When quantity + Price then use aggregate.
(When value terms can be used that are the same)
2. When value terms are different such as bales - tons etc.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Presentation of Data
1. Descriptive data -
a) Narrative
b) Graphical devices
2. Tool for acquiring knowledge
3. Assumption of variability in data

Terms
Population
Sampling } - will approach total
Probability }

Classification of Data
Time
Kind
Geographic (Figures to a section)
Size (Frequency)
definitions are important -
a)

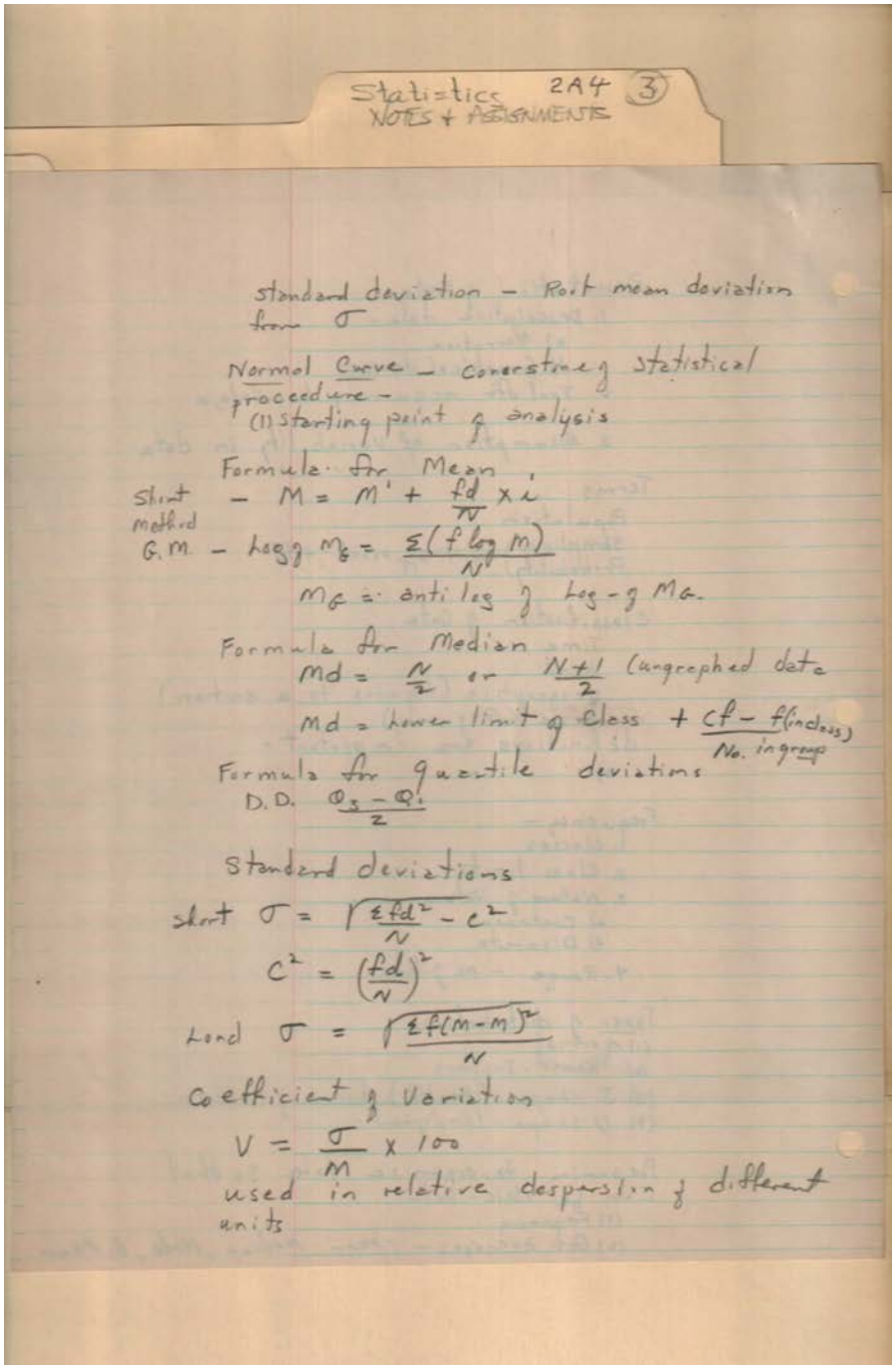
Frequency -
1. classes
2. Class limits
3. Nature of Data
a) Continuous
b) Discrete
4. Range - min. limits

Types of distributions
(1) Normal
(2) Skewed - Income;
(3) J shape (health) disease of Children
(4) U shape - (Employment -

Preparing to organize data so that
Can be described -
(1) Frequency
(2) Get averages - (Mean Median, Mode, G. Mean

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

standard deviation - Root mean deviation from σ

Normal Curve - cornerstone of statistical procedure -
(1) starting point of analysis

Formula for Mean
short method - $M = M' + \frac{fd}{N} \times i$
G.M. - log of $M_g = \frac{\Sigma(f \log m)}{N}$
M_g = anti log of Log of M_g.

Formula for Median
$Md = \frac{N}{2}$ or $\frac{N+1}{2}$ (ungrouped data
Md = lower limit of class + $\frac{cf - f(\text{find class})}{\text{No. in group}}$

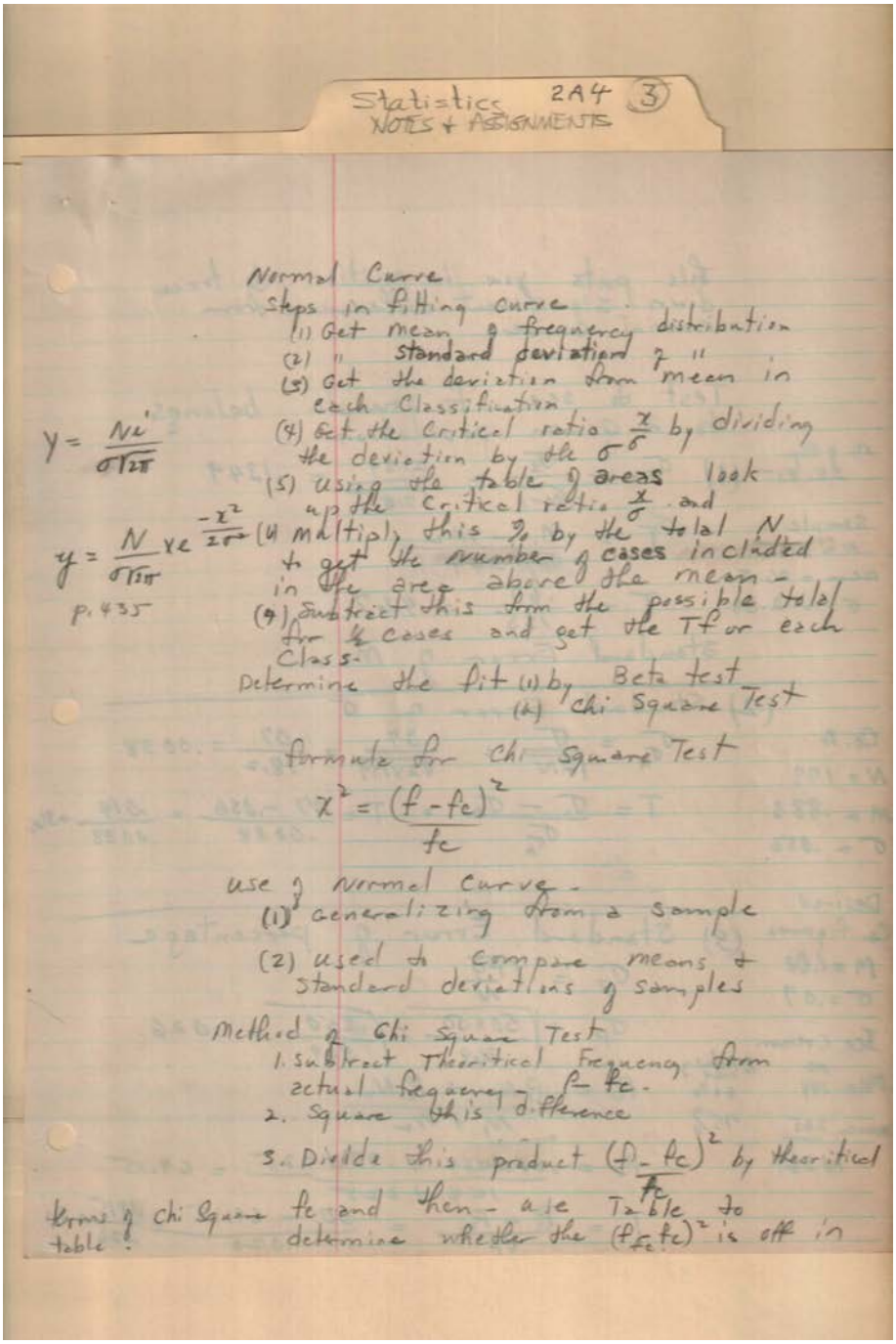
Formula for quartile deviations
D.D. $\frac{Q_3 - Q_1}{2}$

Standard deviations
short $\sigma = \sqrt{\frac{\Sigma fd^2}{N} - c^2}$
$c^2 = \left(\frac{fd}{N}\right)^2$
Long $\sigma = \sqrt{\frac{\Sigma f(m-M)^2}{N}}$

Coefficient of Variation
$V = \frac{\sigma}{M} \times 100$
used in relative dispersion of different units

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Normal Curve
Steps in fitting curve
(1) Get mean of frequency distribution
(2) " standard deviation of "
(3) Get the deviation from mean in each Classification
(4) Get the Critical ratio $\frac{x}{\sigma}$ by dividing the deviation by the σ
(5) using the table of areas look up the Critical ratio $\frac{x}{\sigma}$ and
(4 multiply this % by the total N to get the number of cases included in the area above the mean -
(4) subtract this from the possible total for ½ cases and get the T for each Class.

$y = \frac{Ni'}{\sigma\sqrt{2\pi}}$

$y = \frac{N}{\sigma\sqrt{2\pi}} e^{\frac{-x^2}{2\sigma^2}}$

p. 435

Determine the fit (1) by Beta test
(2) Chi Square Test

formula for Chi Square Test

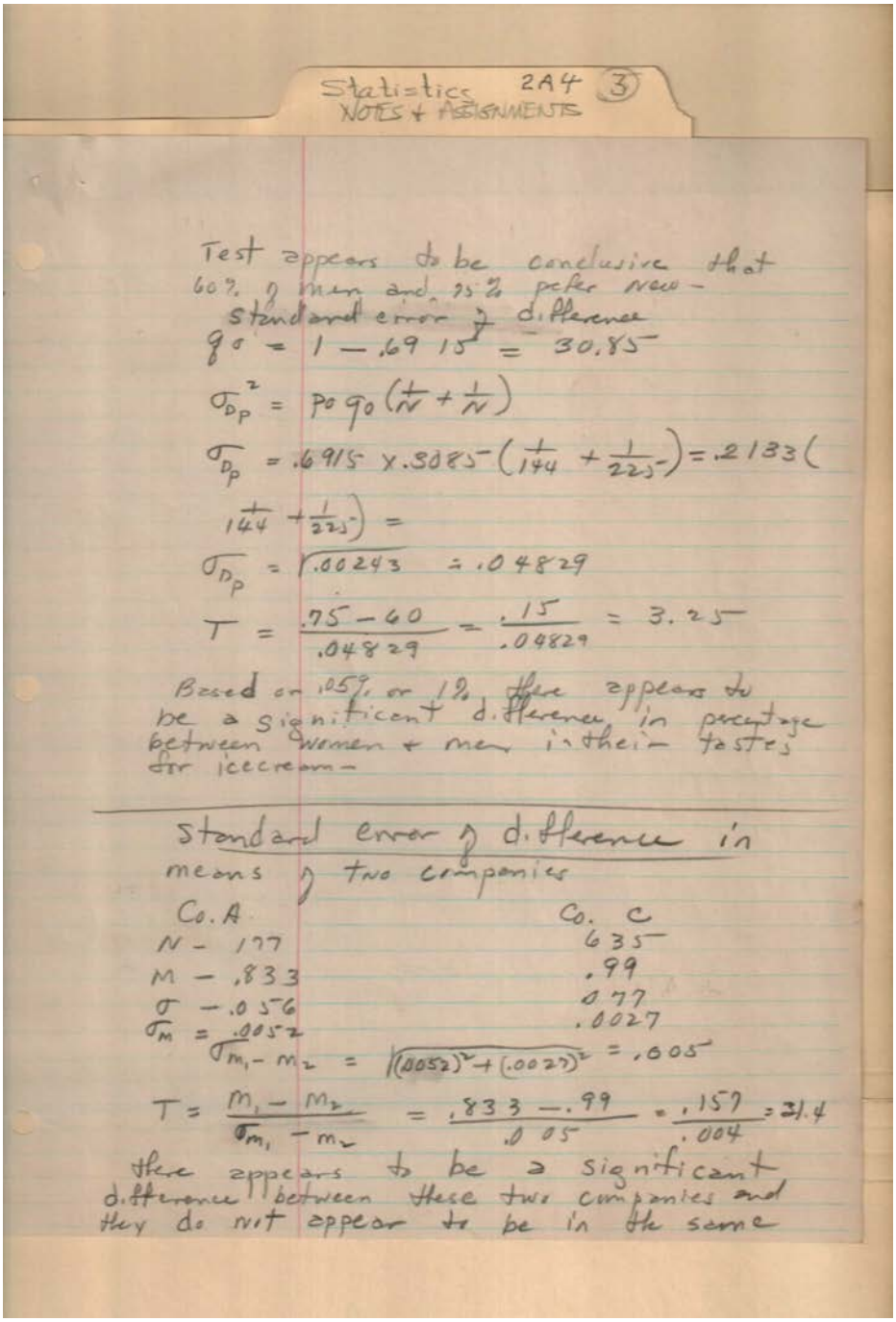
$$\chi^2 = \frac{(f - fe)^2}{fe}$$

use of normal curve.
(1) generalizing from a sample
(2) used to compare means & standard deviations of samples

Method of Chi Square Test
1. subtract Theoritical Frequency from actual frequency - $f - fe$.
2. Square this difference
3. Divide this product $(f - fe)^2$ by theoritical fe and then - a le Table to determine whether the $(f - fe)^2$ is off in terms of chi Square table!

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Test appears to be conclusive that 60% of men and 75% prefer new-
standard error of difference

$q_0 = 1 - .6915 = .3085$

$\sigma_{D_p}^2 = p_0 q_0 \left(\frac{1}{N} + \frac{1}{N}\right)$

$\sigma_{D_p} = .6915 \times .3085 \left(\frac{1}{144} + \frac{1}{225}\right) = .2133 \left(\frac{1}{144} + \frac{1}{225}\right) =$

$\sigma_{D_p} = \sqrt{.00243} = .04829$

$T = \frac{.75 - .60}{.04829} = \frac{.15}{.04829} = 3.25$

Based on .05% or 1% there appears to be a significant difference in percentage between women + men in their tastes for icecream.

Standard error of difference in means of two companies

Co. A	Co. C
$N = 177$	635
$M = .833$	.99
$\sigma = .0556$	.077
$\sigma_M = .0052$	.0027

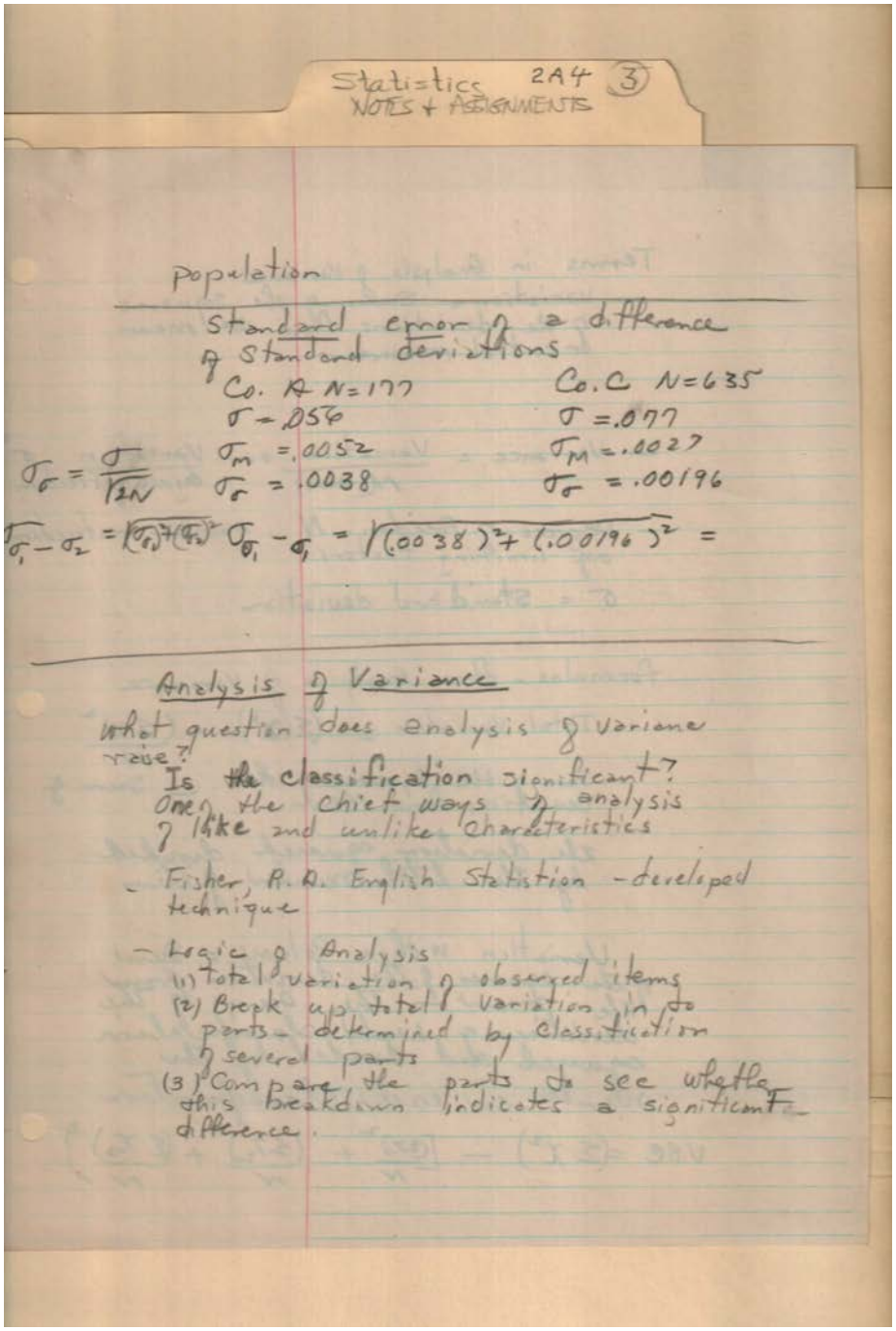
$\sigma_{M_1 - M_2} = \sqrt{(.0052)^2 + (.0027)^2} = .005$

$T = \frac{M_1 - M_2}{\sigma_{M_1 - M_2}} = \frac{.833 - .99}{.005} = \frac{.157}{.004} = 31.4$

there appears to be a significant difference between these two companies and they do not appear to be in the same

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Population

Standard error of a difference
of Standard deviations

	Co. A N=177	Co. C N=635
	σ = .056	σ = .077
$\sigma_\sigma = \frac{\sigma}{\sqrt{2N}}$	σ_M = .0052	σ_M = .0027
	σ_σ = .0038	σ_σ = .00196

$\sigma_{\sigma_1 - \sigma_2} = \sqrt{(\sigma_{\sigma_1})^2 + (\sigma_{\sigma_2})^2}$ $\sigma_{\sigma_1 - \sigma_2} = \sqrt{(.0038)^2 + (.00196)^2} =$

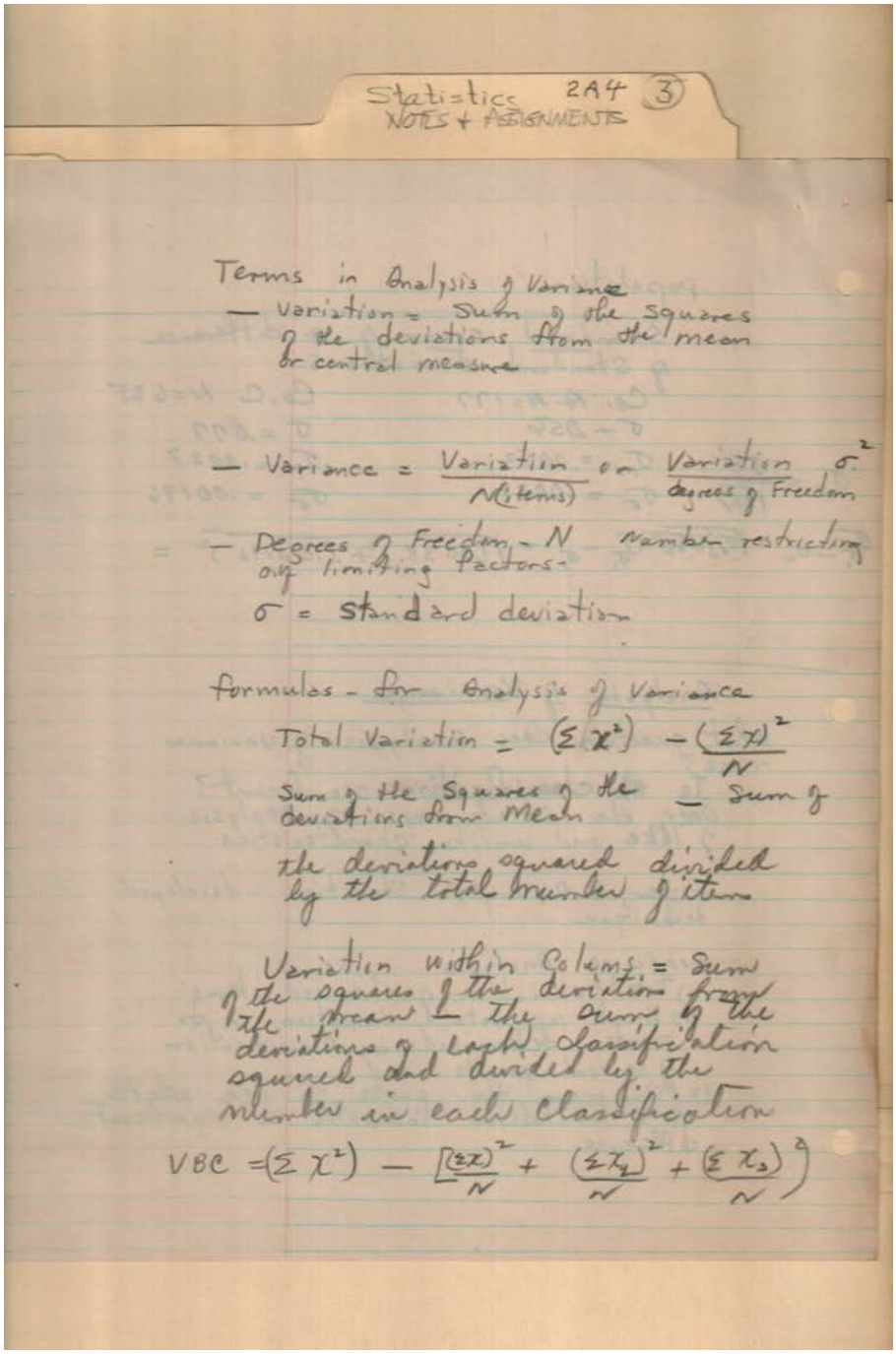
Analysis of Variance

What question does analysis of variance raise?
Is the classification significant?
One of the chief ways of analysis of like and unlike characteristics

- Fisher, R. A. English Statistician - developed technique
- Logic of Analysis
  (1) Total variation of observed items
  (2) Break up total variation into its parts - determined by classification of several parts
  (3) Compare the parts to see whether this breakdown indicates a significant difference.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Terms in Analysis of Variance
— Variation = Sum of the Squares of the deviations from the mean or central measure

— Variance = $\frac{\text{Variation}}{N(\text{items})}$ or $\frac{\text{Variation}}{\text{degrees of Freedom}}$ σ^2

— Degrees of Freedom - N number restricting or limiting factors -

σ = standard deviation

formulas - for Analysis of Variance

Total Variation = $(\Sigma X^2) - \frac{(\Sigma X)^2}{N}$

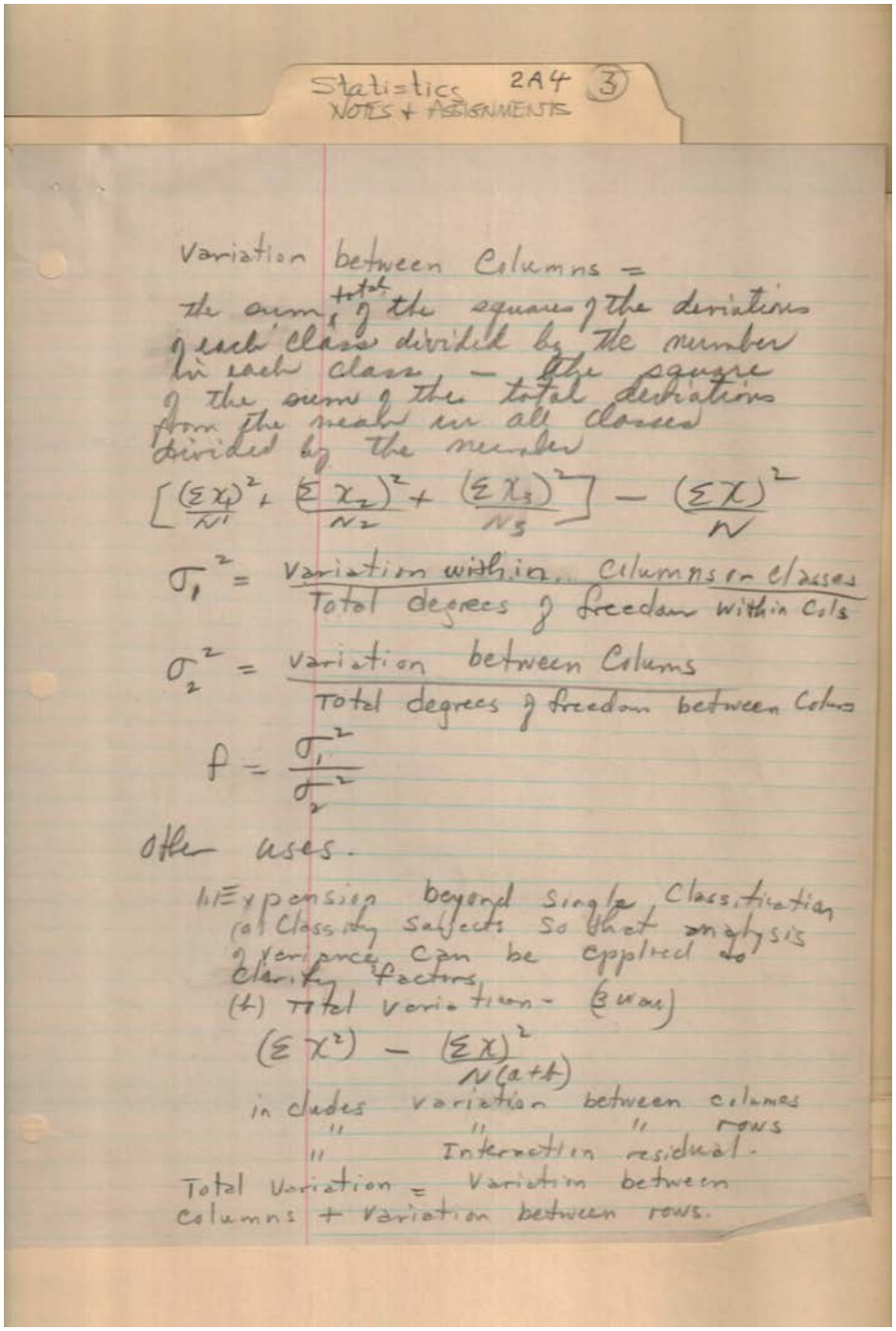
Sum of the Squares of the deviations from Mean — Sum of the deviations squared divided by the total number of items

Variation within Colums = Sum the squares of the deviation from the mean — the sum of the deviations of each classification squared and divided by the number in each classification

$VBC = (\Sigma X^2) - \left[\frac{(\Sigma X)^2}{N} + \frac{(\Sigma X_2)^2}{N} + \frac{(\Sigma X_3)^2}{N}\right)$

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Variation between Columns =
the sum of the squares of the deviations of each class divided by the number in each class − the square of the sum of the total deviations from the mean in all classes divided by the number

$$\left[\frac{(\Sigma x_1)^2}{N_1} + \frac{(\Sigma x_2)^2}{N_2} + \frac{(\Sigma x_3)^2}{N_3}\right] - \frac{(\Sigma x)^2}{N}$$

$$\sigma_1^2 = \frac{\text{Variation within columns or classes}}{\text{Total degrees of freedom within Cols}}$$

$$\sigma_2^2 = \frac{\text{Variation between Columns}}{\text{Total degrees of freedom between Cols}}$$

$$f = \frac{\sigma_1^2}{\sigma_2^2}$$

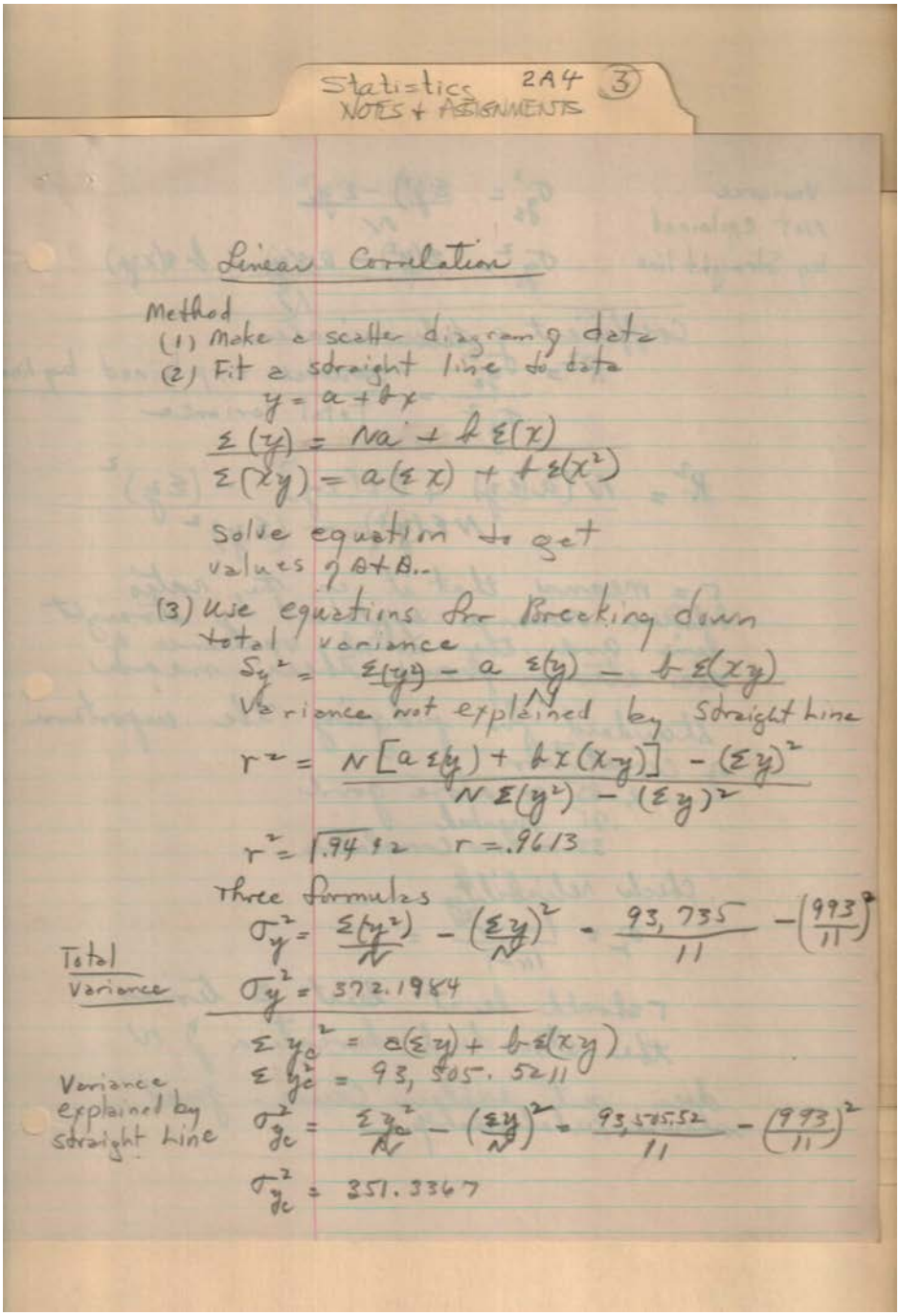
Other uses.

1. Expansion beyond single classification
   (a) Classify subjects so that analysis of variance can be applied to classify factors
   (b) Total variation = (sum)
   $$(\Sigma x^2) - \frac{(\Sigma x)^2}{N(a+b)}$$
   includes variation between columns
   " " " rows
   " Interaction residual.

Total variation = Variation between Columns + Variation between rows.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Linear Correlation

Method
(1) Make a scatter diagram of data
(2) Fit a straight line to data
$y = a + bx$

$\Sigma(y) = Na + b\Sigma(x)$
$\Sigma(xy) = a(\Sigma x) + b\Sigma(x^2)$

Solve equation to get values of A+B..

(3) Use equations for Breaking down total variance

$S_y^2 = \Sigma(y^2) - a\Sigma(y) - b\Sigma(xy)$

Variance not explained by straight line

$r^2 = \dfrac{N[a\Sigma(y) + bx(xy)] - (\Sigma y)^2}{N\Sigma(y^2) - (\Sigma y)^2}$

$r^2 = .9492 \quad r = .9613$

Three formulas

Total variance

$\sigma_y^2 = \dfrac{\Sigma(y^2)}{N} - \left(\dfrac{\Sigma y}{N}\right)^2 = \dfrac{93,735}{11} - \left(\dfrac{993}{11}\right)^2$

$\sigma_y^2 = 372.1984$

Variance explained by straight line

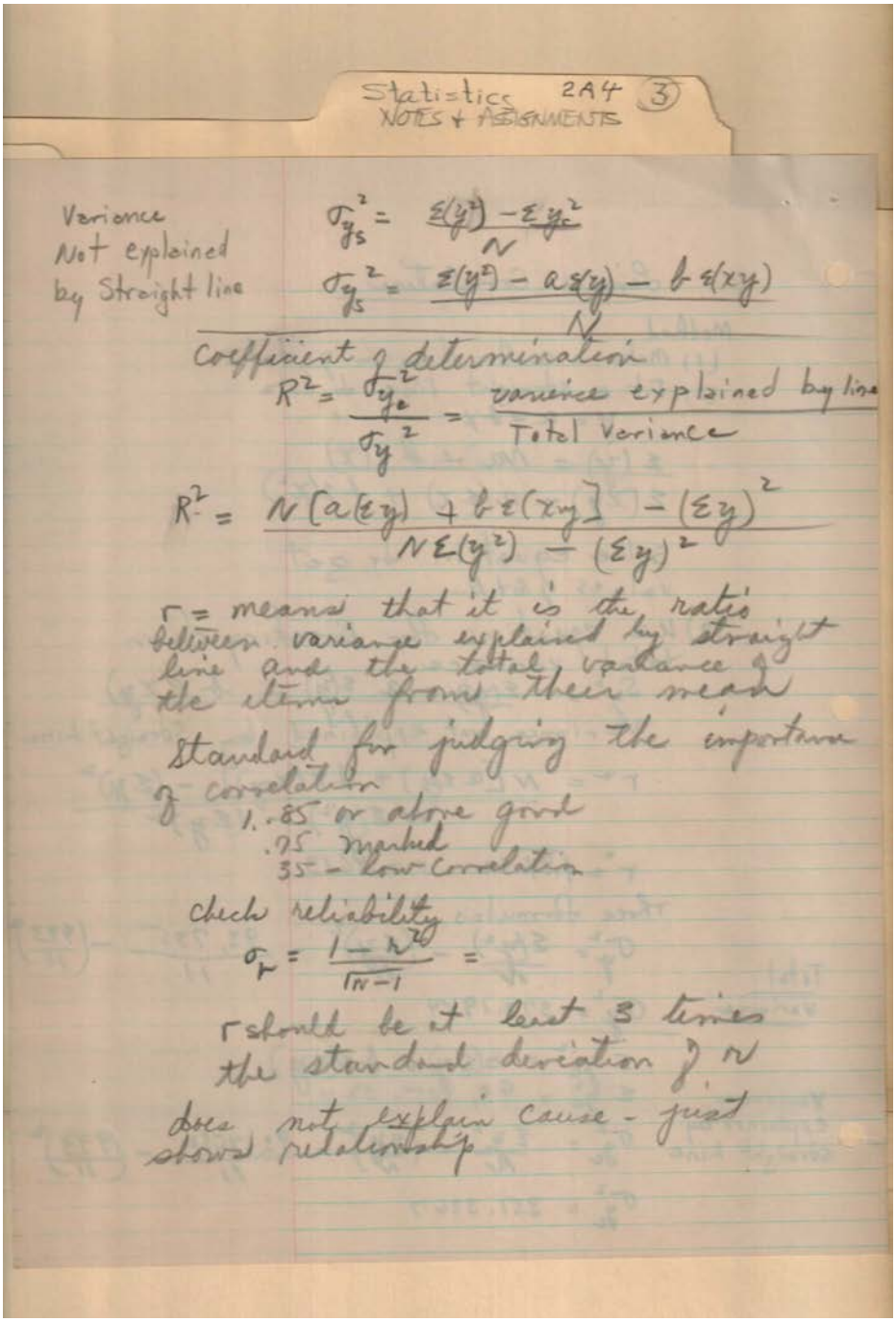
$\Sigma y_c^2 = a(\Sigma y) + b(\Sigma xy)$
$\Sigma y_c^2 = 93,505.5211$

$\sigma_{y_c}^2 = \dfrac{\Sigma y_c^2}{N} - \left(\dfrac{\Sigma y}{N}\right)^2 = \dfrac{93,505.52}{11} - \left(\dfrac{993}{11}\right)^2$

$\sigma_{y_c}^2 = 351.3367$

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Variance Not explained by Straight line

$$\sigma_{y_s}^2 = \frac{\Sigma(y^2) - \Sigma y_c^2}{N}$$

$$\sigma_{y_s}^2 = \frac{\Sigma(y^2) - a\Sigma(y) - b\Sigma(xy)}{N}$$

Coefficient of determination

$$R^2 = \frac{\sigma_{y_c}^2}{\sigma_y^2} = \frac{\text{variance explained by line}}{\text{Total Variance}}$$

$$R^2 = \frac{N[a\Sigma(y) + b\Sigma(xy)] - (\Sigma y)^2}{N\Sigma(y^2) - (\Sigma y)^2}$$

r = means that it is the ratio between variance explained by straight line and the total variance of the items from their mean

Standard for judging the importance of correlation
1. .85 or above good
.75 marked
35 - low correlation

check reliability

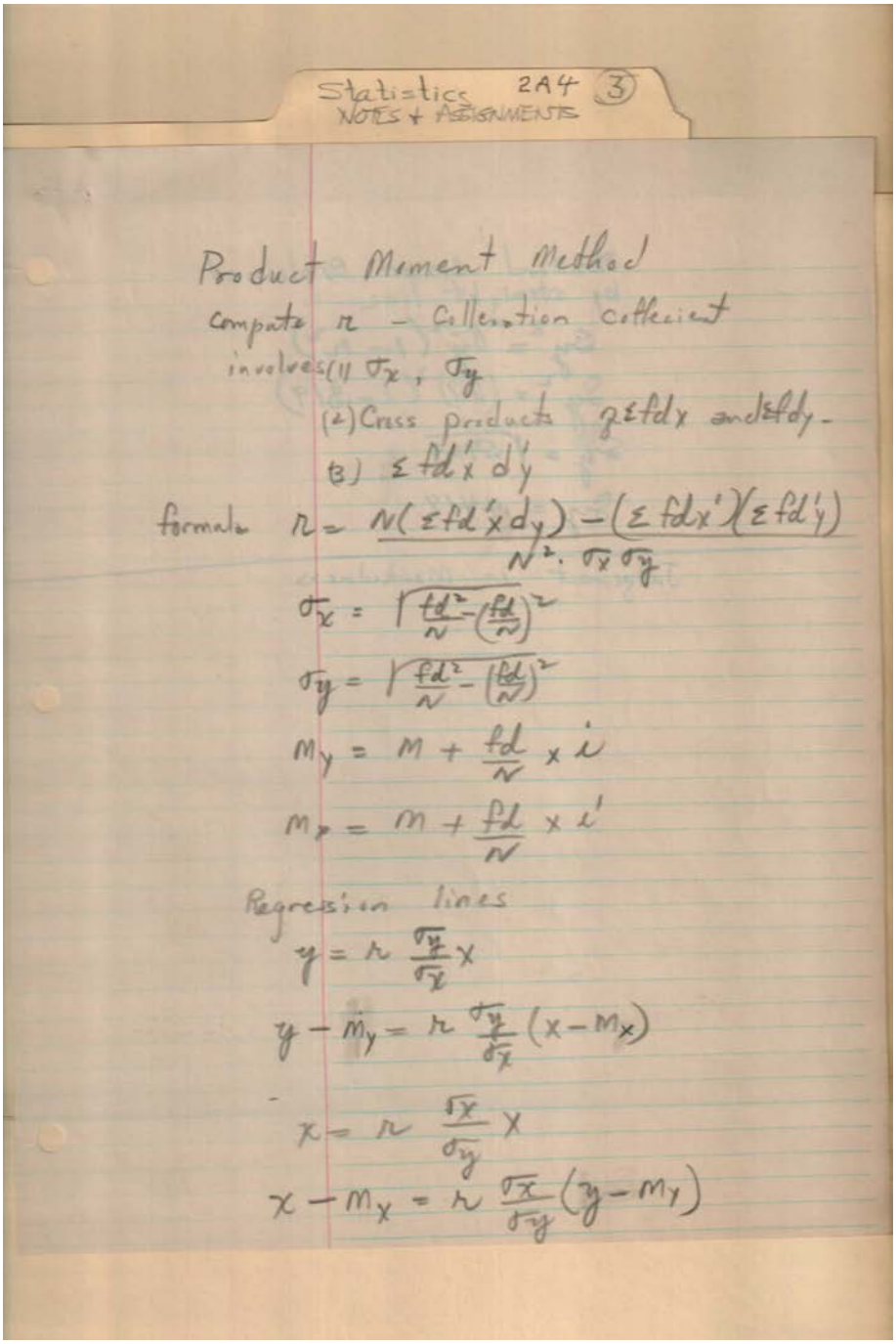
$$\sigma_r = \frac{1 - r^2}{\sqrt{N-1}} =$$

r should be at least 3 times the standard deviation of N

does not explain cause - just shows relationship

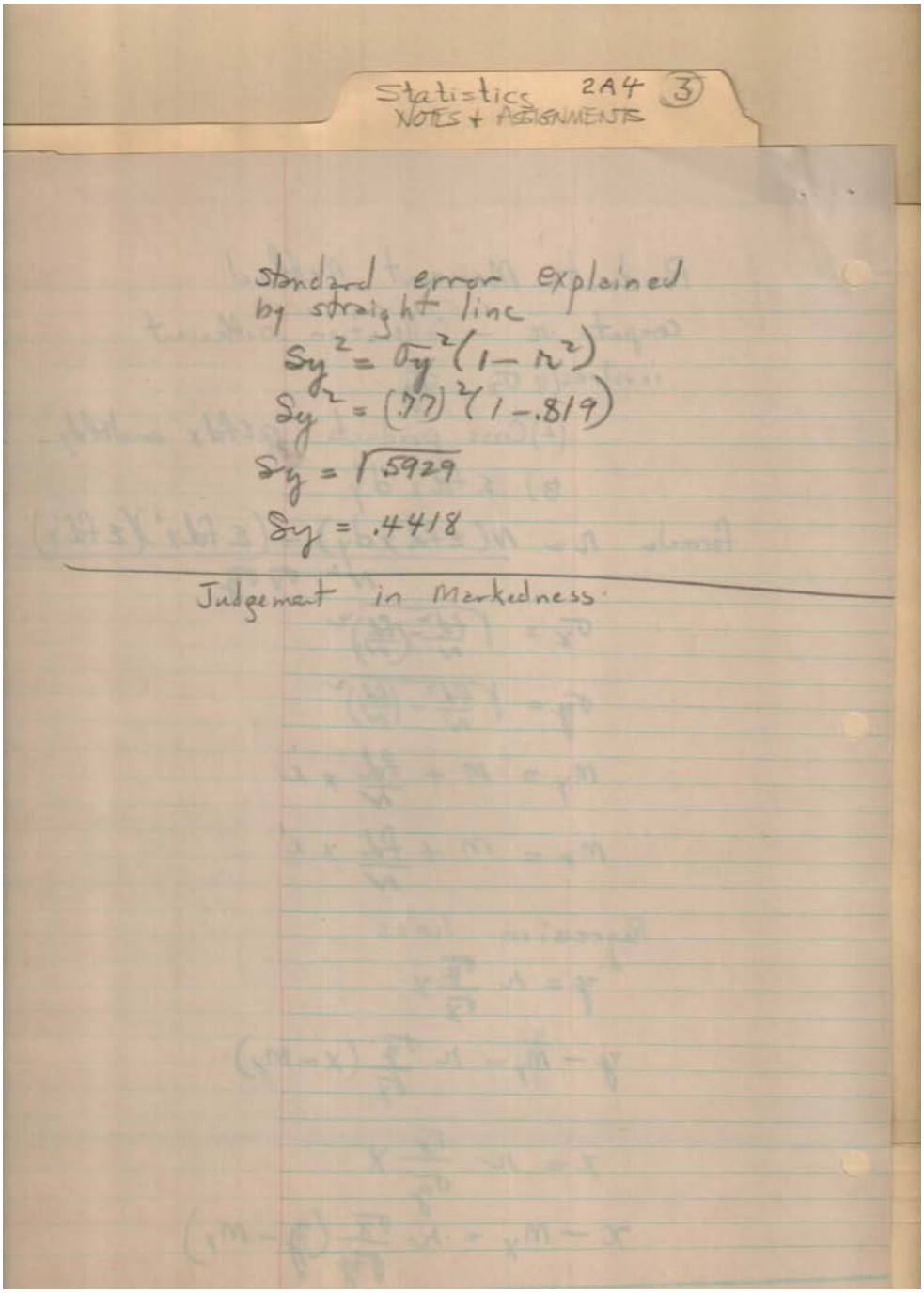
Names:
Business Statistics

Types:
notes



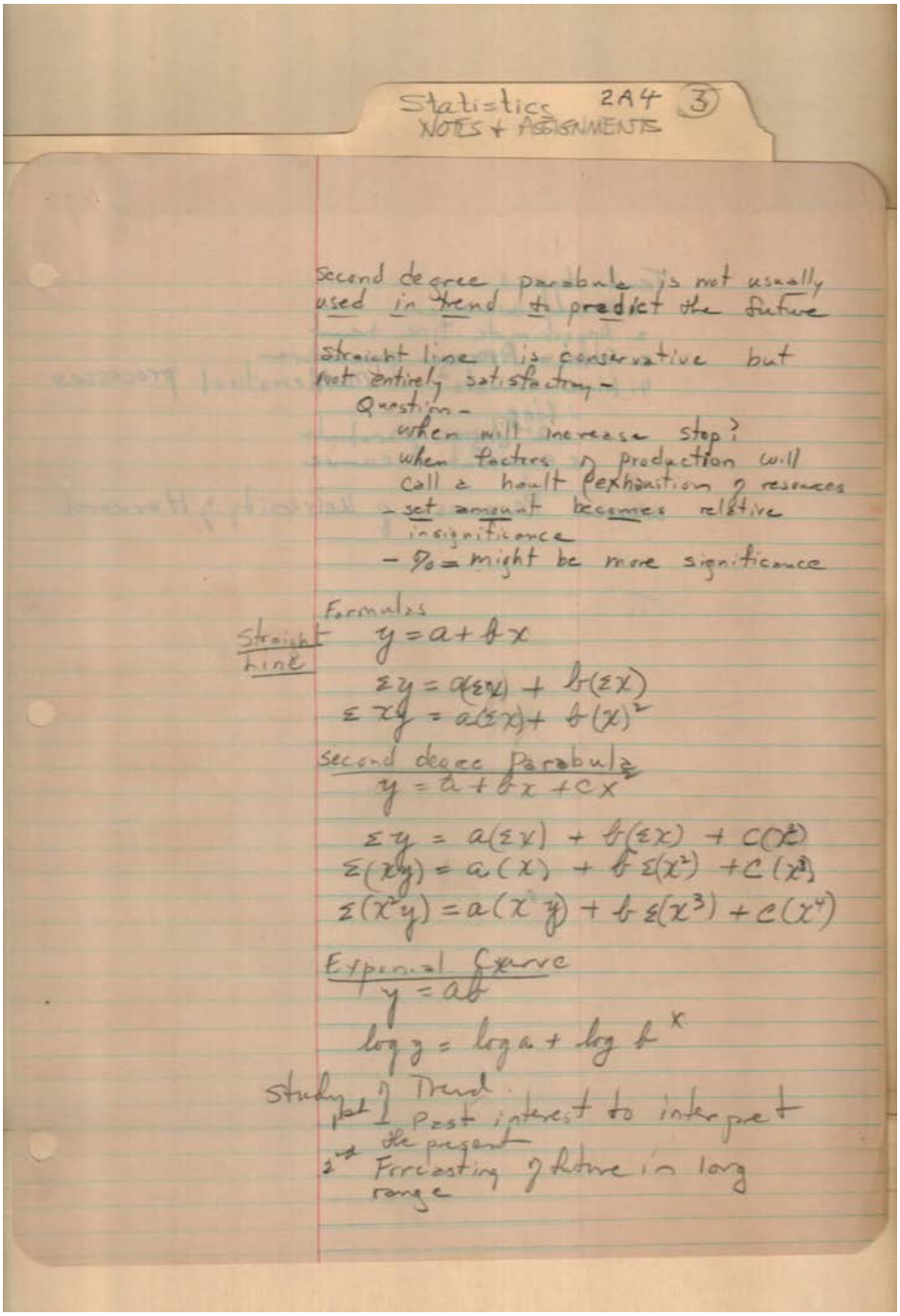
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Second degree parabola is not usually used in trend to predict the future

straight line is conservative but not entirely satisfactory -
Question -
when will increase stop?
when factors of production will call a halt Exhaustion of resources
- set amount becomes relative insignificance
- % = might be more significance

Formulas

Straight line $y = a + bx$

$\Sigma y = a(\Sigma x) + b(\Sigma x)$
$\Sigma xy = a(\Sigma x) + b(x)^2$

Second degree Parabola
$y = a + bx + cx$

$\Sigma y = a(\Sigma x) + b(\Sigma x) + c(x^2)$
$\Sigma(xy) = a(x) + b\Sigma(x^2) + c(x^3)$
$\Sigma(x^2y) = a(x^2y) + b\Sigma(x^3) + c(x^4)$

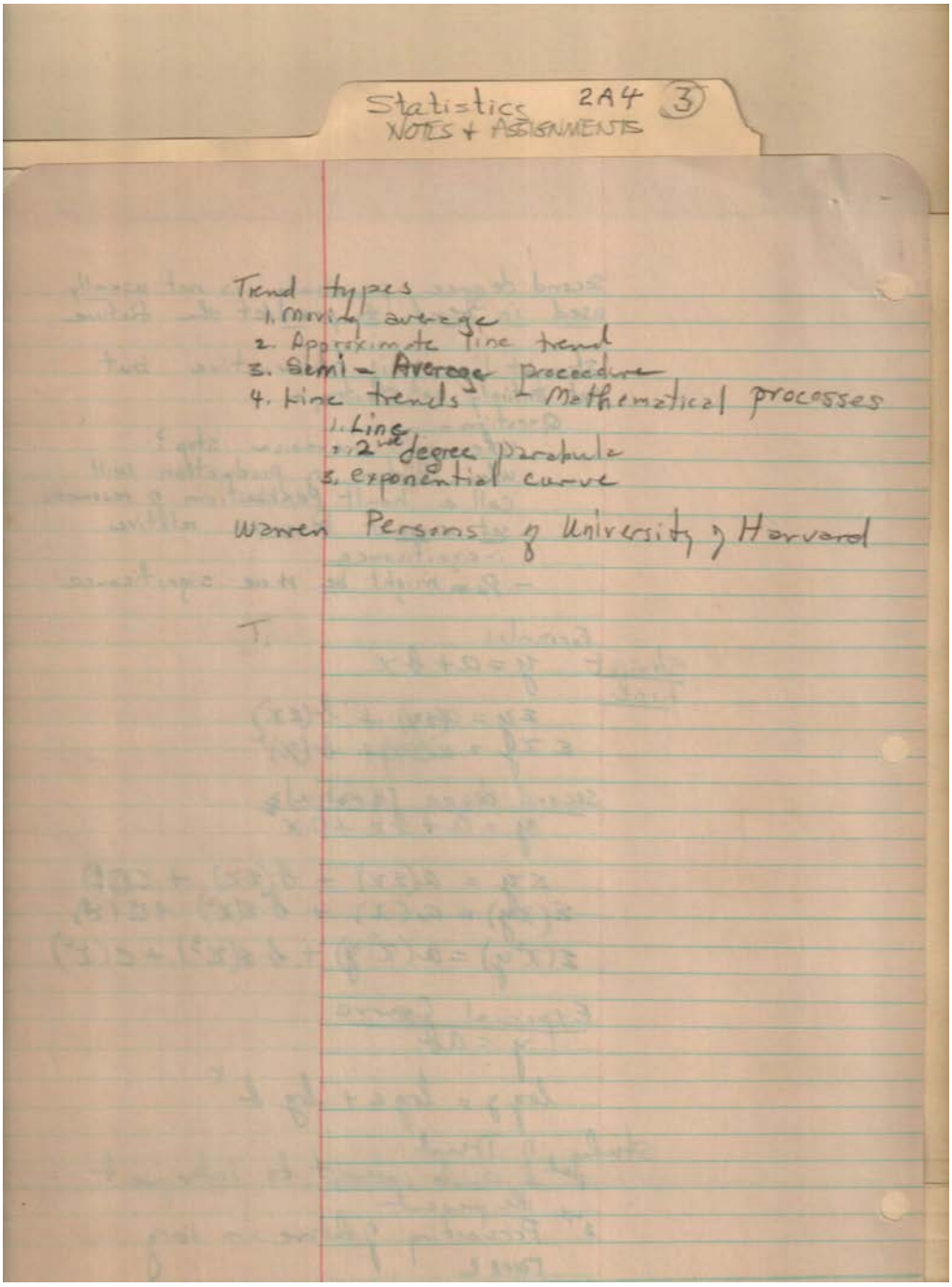
Exponential Curve
$y = ab$

$\log y = \log a + \log b^x$

Study of Trend
1st Past interest to interpret the present
2nd Forecasting of future in long range

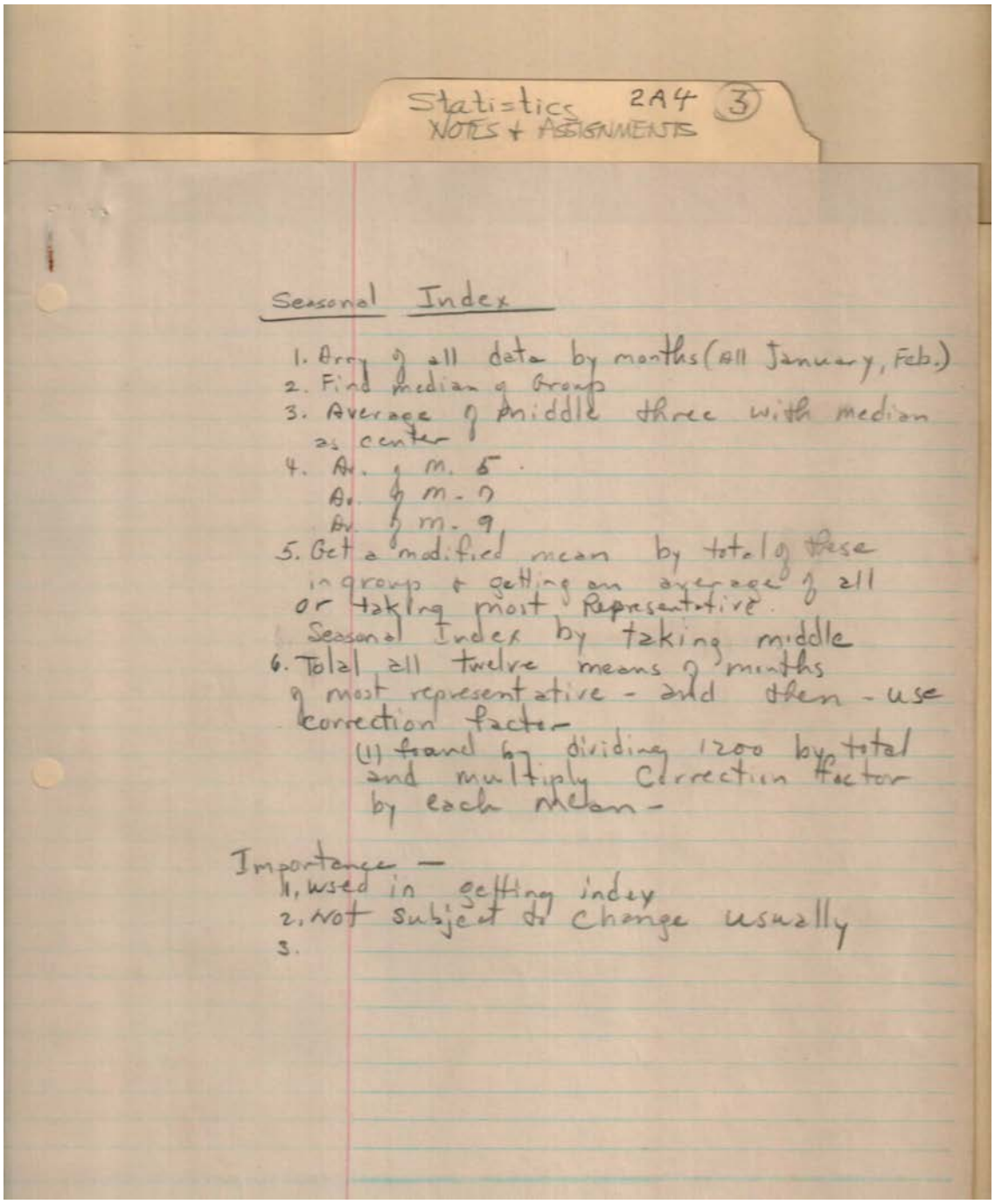
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

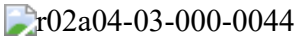
Seasonal Index

1. Array of all data by months (All January, Feb.)
2. Find median of Groups
3. Average of middle three with median as center
4. Av. of m. 5
   Av. of m. 7
   Av. of m. 9
5. Get a modified mean by totaling these in groups & getting an average of all or taking most Representative. Seasonal Index by taking middle
6. Total all twelve means of months of most representative - and then - use correction factor
   (1) found by dividing 1200 by total and multiply correction factor by each mean -

Importance —
1. used in getting index
2. not subject to change usually
3.

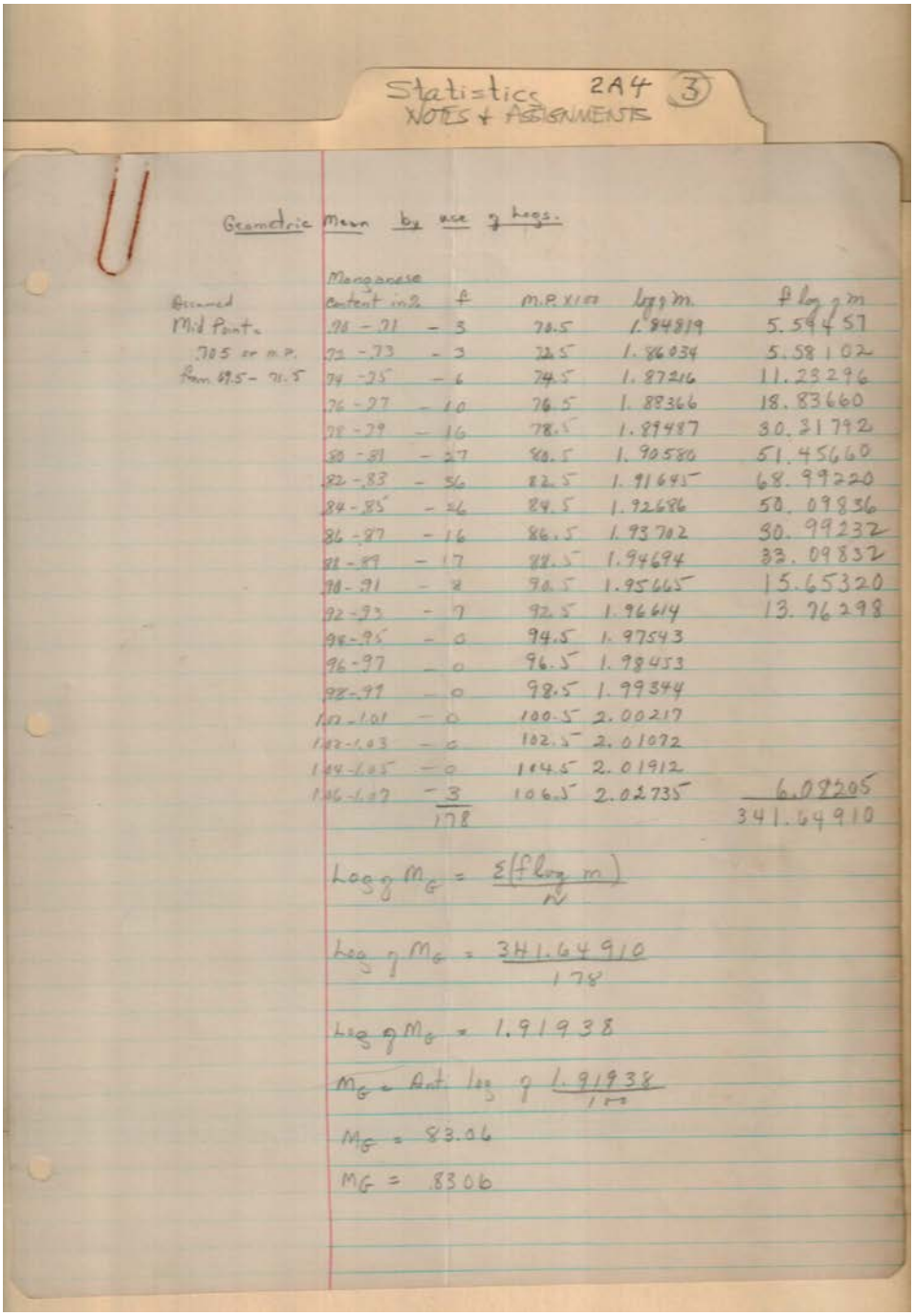
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Geometric Mean by use of logs.

Grouped Mid Points 705 or m.p. from 69.5 - 71.5

Manganese content in %	f	m.p. x in	log m.	f log m
70 - 71	3	70.5	1.84819	5.54457
72 - 73	3	72.5	1.86034	5.58102
74 - 75	6	74.5	1.87216	11.23296
76 - 77	10	76.5	1.88366	18.83660
78 - 79	16	78.5	1.89487	30.31792
80 - 81	27	80.5	1.90580	51.45660
82 - 83	36	82.5	1.91645	68.99220
84 - 85	26	84.5	1.92686	50.09836
86 - 87	16	86.5	1.93702	30.99232
88 - 89	17	88.5	1.94694	33.09832
90 - 91	8	90.5	1.95665	15.65320
92 - 93	7	92.5	1.96614	13.76298
94 - 95	0	94.5	1.97543	
96 - 97	0	96.5	1.98453	
98 - 99	0	98.5	1.99344	
100 - 101	0	100.5	2.00217	
102 - 103	0	102.5	2.01072	
104 - 105	0	104.5	2.01912	
106 - 107	3	106.5	2.02735	6.08205
	178			341.64910

$\log_g M_G = \frac{\Sigma(f \log m)}{N}$

$\log_g M_G = \frac{341.64910}{178}$

$\log_g M_G = 1.91938$

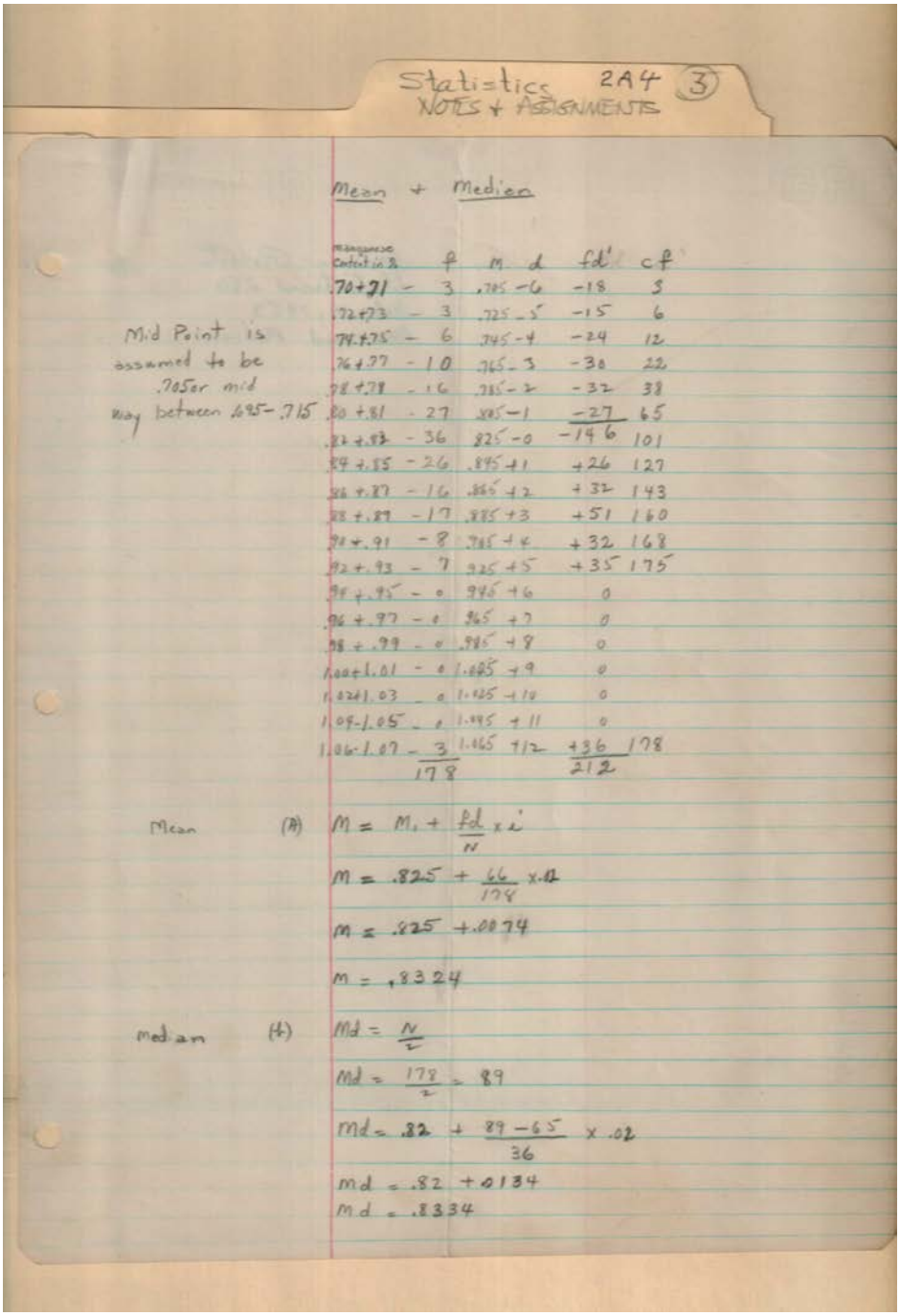
$M_G = \text{Anti log}_g \frac{1.91938}{100}$

$M_G = 83.06$

$M_G = 8306$

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Mean + Median

Consecutive Centers	f	M	d	fd'	cf
.70+.71	3	.705	-6	-18	3
.72+.73	3	.725	-5	-15	6
.74+.75	6	.745	-4	-24	12
.76+.77	10	.765	-3	-30	22
.78+.79	16	.785	-2	-32	38
.80+.81	27	.805	-1	-27	65
.82+.83	36	.825	-0	-146	101
.84+.85	26	.845	+1	+26	127
.86+.87	16	.865	+2	+32	143
.88+.89	17	.885	+3	+51	160
.90+.91	8	.905	+4	+32	168
.92+.93	7	.925	+5	+35	175
.94+.95	0	.945	+6	0	
.96+.97	0	.965	+7	0	
.98+.99	0	.985	+8	0	
1.00+1.01	0	1.005	+9	0	
1.02+1.03	0	1.025	+10	0	
1.04+1.05	0	1.045	+11	0	
1.06+1.07	3	1.065	+12	+36	178
	178			212	

Mid Point is assumed to be .705 or mid way between .695 - .715

Mean (A) $M = M_0 + \frac{fd}{N} \times i$

$M = .825 + \frac{66}{178} \times .02$

$M = .825 + .0074$

$M = .8324$

median (B) $Md = \frac{N}{2}$

$Md = \frac{178}{2} = 89$

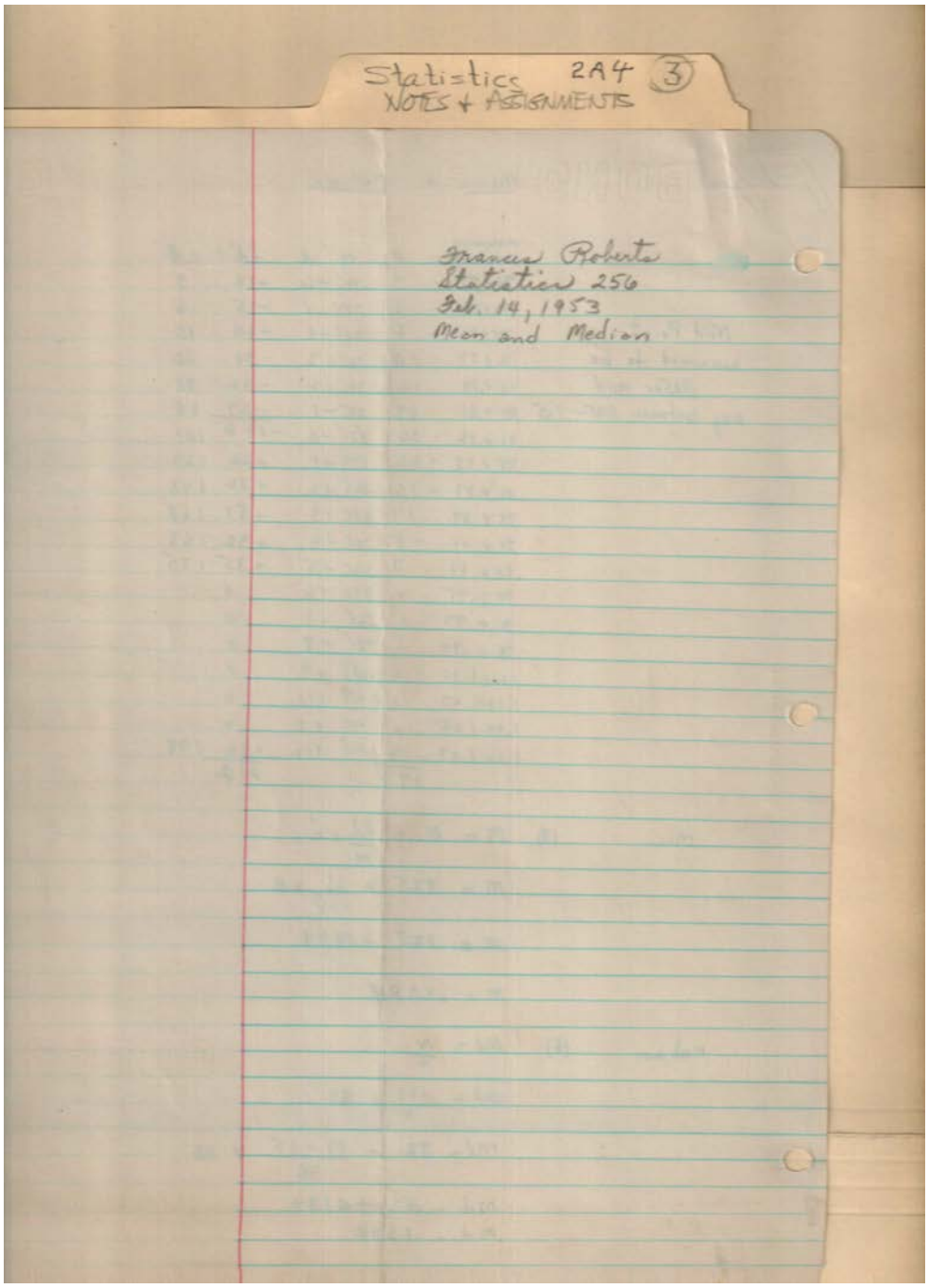
$md = .82 + \frac{89 - 65}{36} \times .02$

$md = .82 + .0134$

$md = .8334$

Names:
Business Statistics

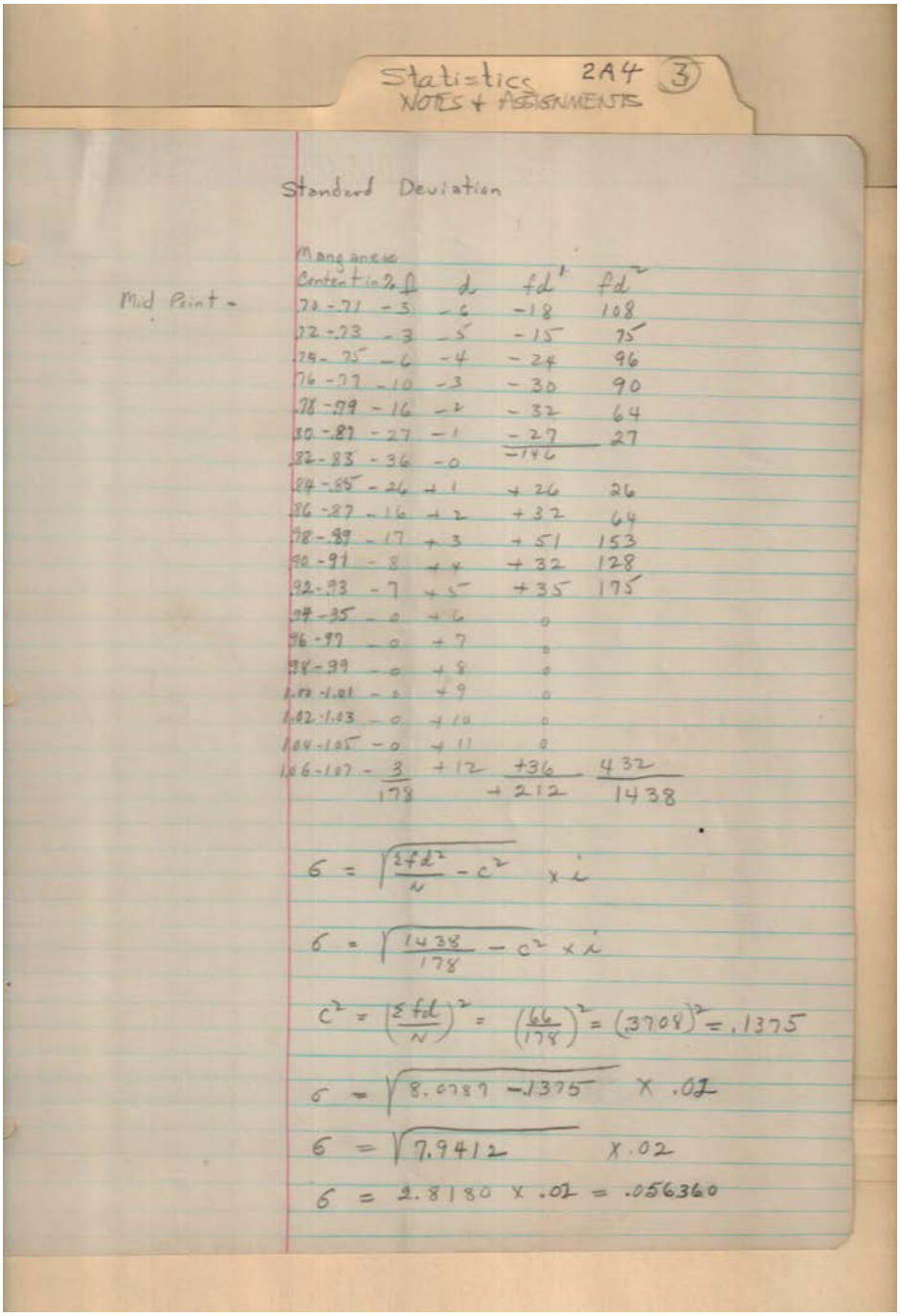
Types:
notes



Names:
Roberts, Frances

Types:
notes

Dates:
Feb 14, 1953



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Standard Deviation

Mid Point -	Manganese Content in %	f	d	fd'	fd²
	.70-.71	-5	-6	-18	108
	.72-.73	-3	-5	-15	75
	.74-.75	-6	-4	-24	96
	.76-.77	-10	-3	-30	90
	.78-.79	-16	-2	-32	64
	.80-.81	-27	-1	-27	27
	.82-.83	-36	-0	-146	
	.84-.85	-26	+1	+26	26
	.86-.87	-16	+2	+32	64
	.88-.89	-17	+3	+51	153
	.90-.91	-8	+4	+32	128
	.92-.93	-7	+5	+35	175
	.94-.95	-0	+6	0	
	.96-.97	-0	+7	0	
	.98-.99	-0	+8	0	
	1.00-1.01	-0	+9	0	
	1.02-1.03	-0	+10	0	
	1.04-1.05	-0	+11	0	
	1.06-1.07	-3	+12	+36	432
		178		+212	1438

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N} - c^2} \times i$$

$$\sigma = \sqrt{\frac{1438}{178} - c^2} \times i$$

$$c^2 = \left(\frac{\Sigma fd}{N}\right)^2 = \left(\frac{66}{178}\right)^2 = (.3708)^2 = .1375$$

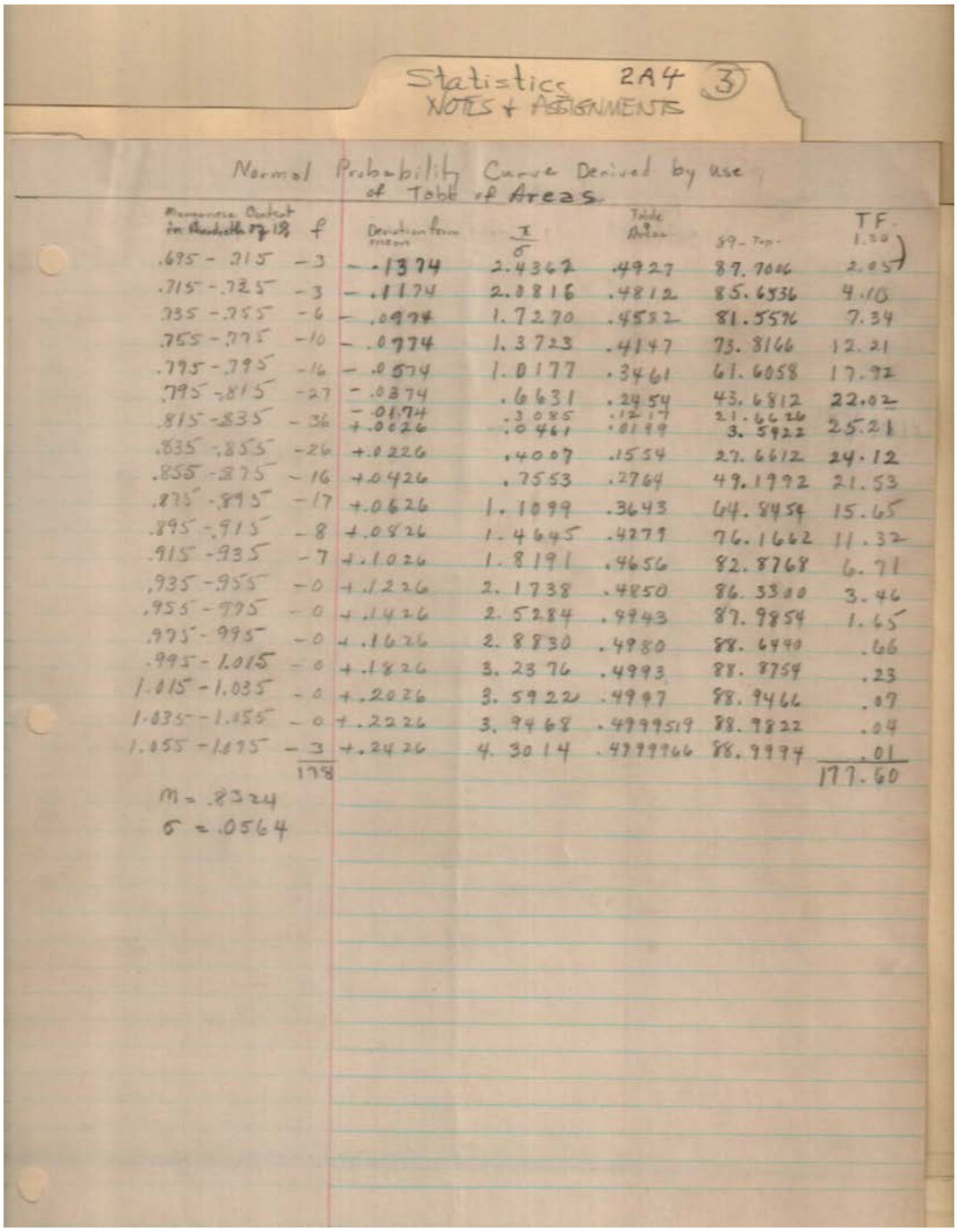
$$\sigma = \sqrt{8.0787 - .1375} \times .02$$

$$\sigma = \sqrt{7.9412} \times .02$$

$$\sigma = 2.8180 \times .02 = .056360$$

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

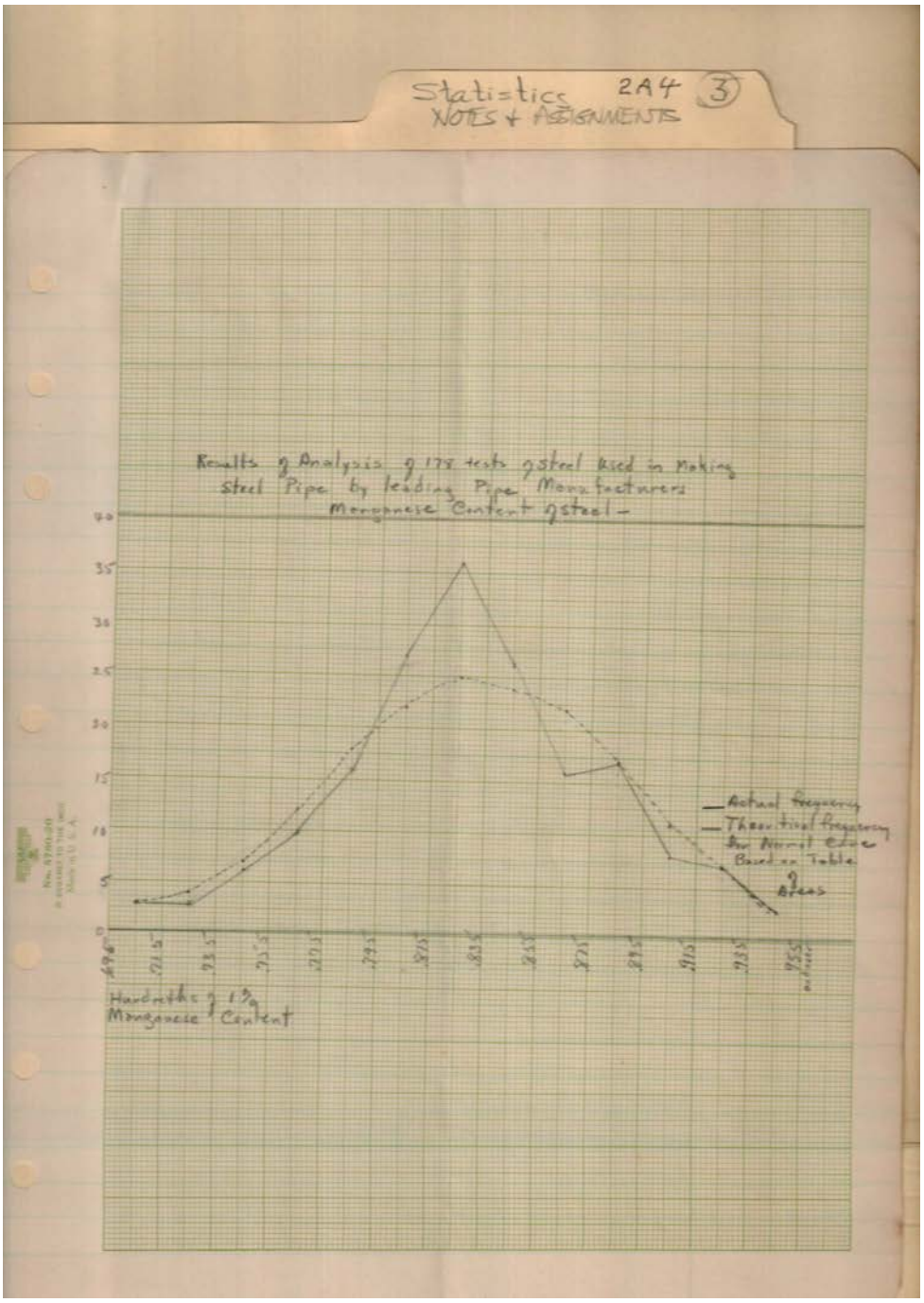
Normal Probability Curve Derived by use of Table of Areas.

Measures Output in Hundredths of 1%	f	Deviation from mean	$\frac{x}{\sigma}$	Table Area	89 - Top -	TF. 1.30
.695 - .715	-3	-.1374	2.4362	.4927	89.7006	2.05
.715 - .735	-3	-.1174	2.3816	.4812	85.6536	4.10
.735 - .755	-6	-.0974	1.7270	.4582	81.5576	7.34
.755 - .775	-10	-.0774	1.3723	.4147	73.8166	12.21
.775 - .795	-16	-.0574	1.0177	.3461	61.6058	17.92
.795 - .815	-27	-.0374	.6631	.2454	43.6812	22.02
.815 - .835	-36	-.0174	.3085	.1217	21.6626	25.21
		+.0026	.0461	.0199	3.5922	
.835 - .855	-26	+.0226	.4007	.1554	27.6612	24.12
.855 - .875	-16	+.0426	.7553	.2764	49.1992	21.53
.875 - .895	-17	+.0626	1.1099	.3643	64.8454	15.65
.895 - .915	-8	+.0826	1.4645	.4279	76.1662	11.32
.915 - .935	-7	+.1026	1.8191	.4656	82.8768	6.71
.935 - .955	-0	+.1226	2.1738	.4850	86.3300	3.46
.955 - .975	-0	+.1426	2.5284	.4943	87.9854	1.65
.975 - .995	-0	+.1626	2.8830	.4980	88.6490	.66
.995 - 1.015	-0	+.1826	3.2376	.4993	88.8754	.23
1.015 - 1.035	-0	+.2026	3.5922	.4997	88.9466	.07
1.035 - 1.055	-0	+.2226	3.9468	.4999519	88.9822	.04
1.055 - 1.075	-3	+.2426	4.3014	.4999966	88.9994	.01
	178					177.60

$m = .8324$
$\sigma = .0564$

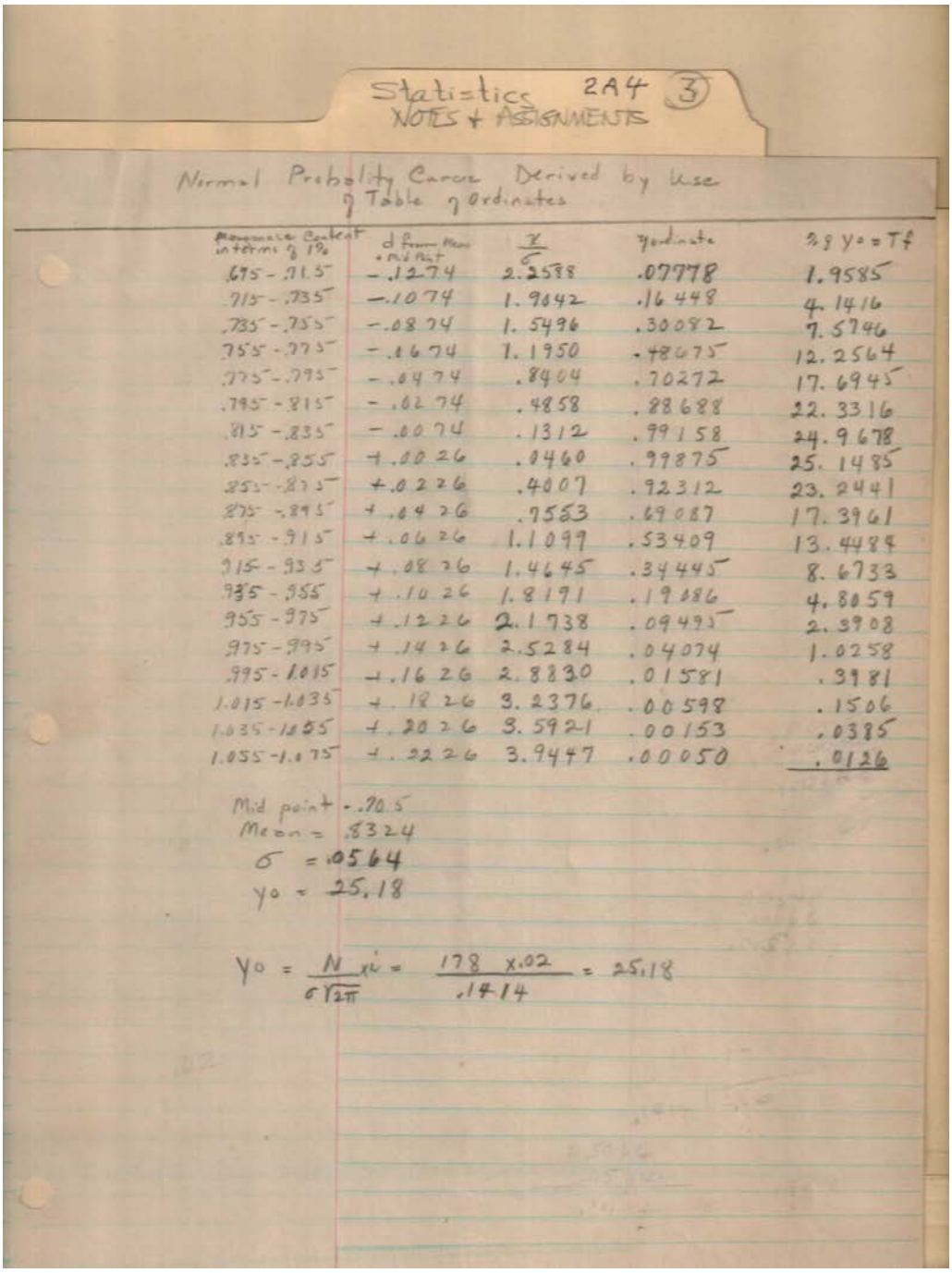
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Normal Probability Curve Derived by Use of Table of Ordinates

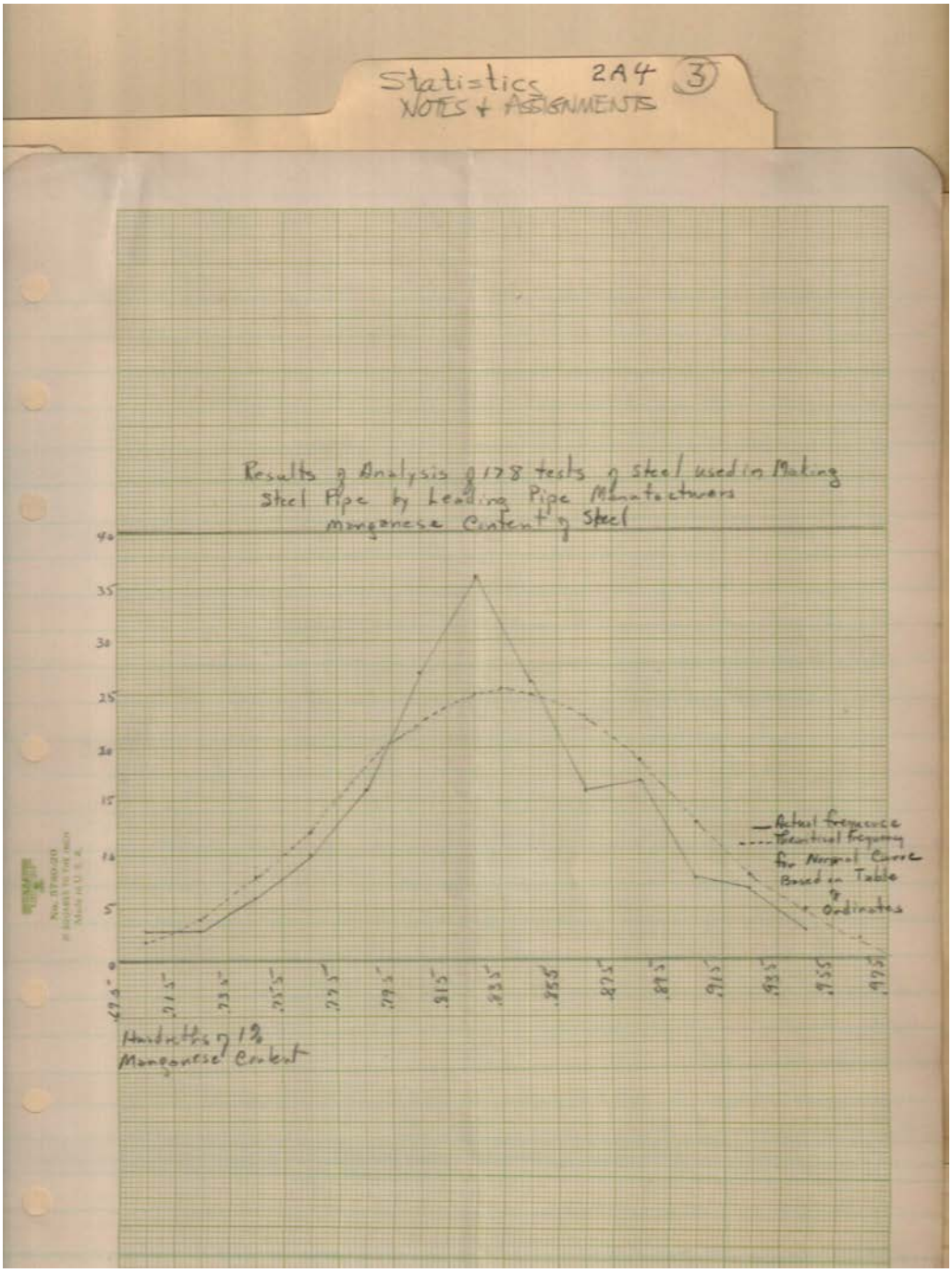
Area in terms of σ	d from Mean in Mid Pt	$\frac{x}{\sigma}$	Ordinate	28 $y_o = Tf$
.675 - .715	-.1274	2.2588	.07778	1.9585
.715 - .735	-.1074	1.9042	.16448	4.1416
.735 - .755	-.0874	1.5496	.30082	7.5746
.755 - .775	-.0674	1.1950	.48075	12.2564
.775 - .795	-.0474	.8404	.70272	17.6945
.795 - .815	-.0274	.4858	.88688	22.3316
.815 - .835	-.0074	.1312	.99158	24.9678
.835 - .855	+.0026	.0460	.99875	25.1485
.855 - .875	+.0226	.4007	.92312	23.2441
.875 - .895	+.0426	.7553	.69087	17.3961
.895 - .915	+.0626	1.1099	.53409	13.4489
.915 - .935	+.0826	1.4645	.34445	8.6733
.935 - .955	+.1026	1.8191	.19086	4.8059
.955 - .975	+.1226	2.1738	.09493	2.3908
.975 - .995	+.1426	2.5284	.04074	1.0258
.995 - 1.015	+.1626	2.8830	.01581	.3981
1.015 - 1.035	+.1826	3.2376	.00598	.1506
1.035 - 1.055	+.2026	3.5921	.00153	.0385
1.055 - 1.075	+.2226	3.9447	.00050	.0126

Mid point = .705
Mean = .8324
σ = .0564
y_o = 25.18

$$y_o = \frac{N\,x'}{\sigma\sqrt{2\pi}} = \frac{178 \times .02}{.1414} = 25.18$$

Names:
Business Statistics

Types:
notes

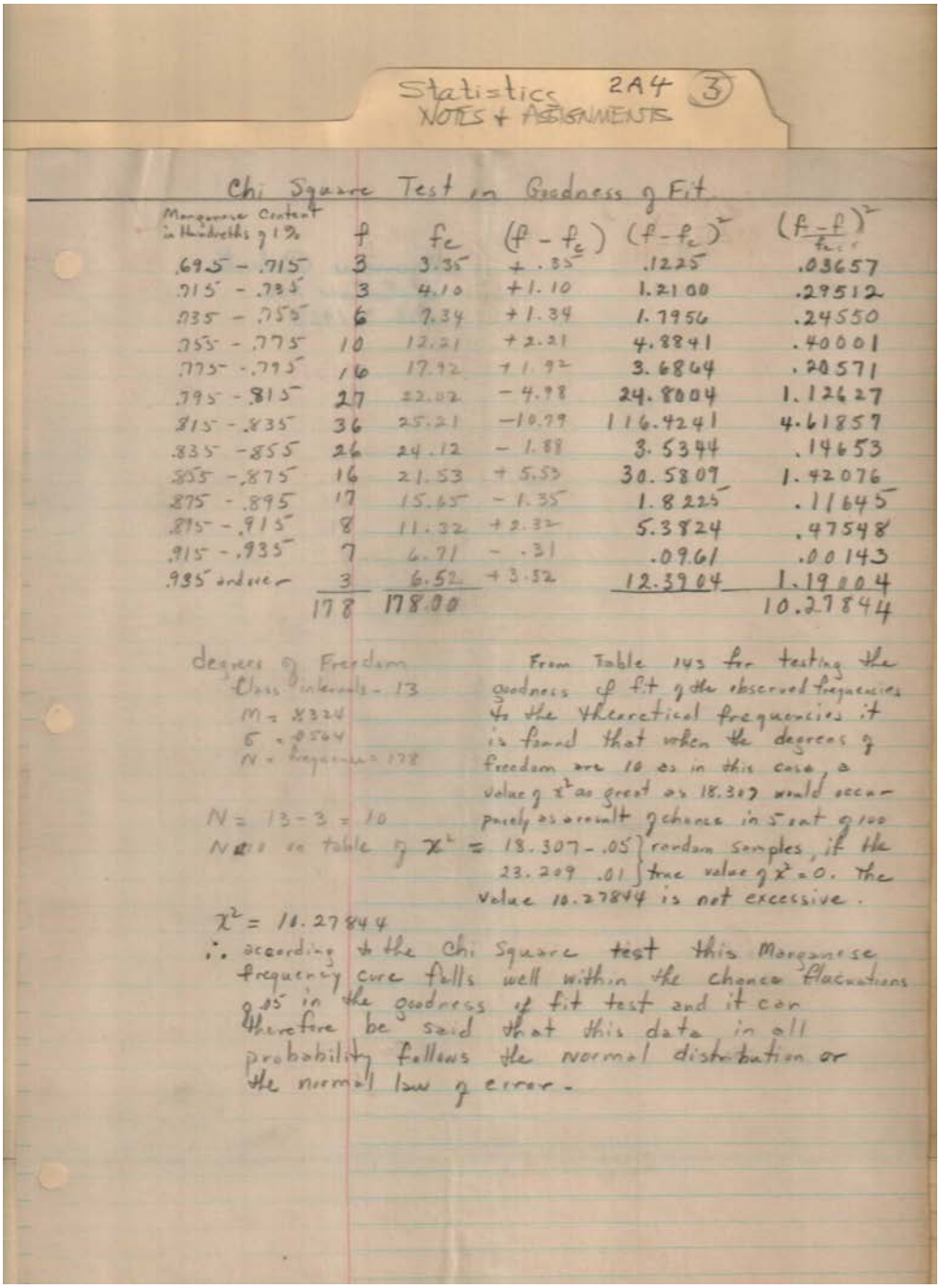


Names:

Business Statistics

Types:

notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Chi Square Test in Goodness of Fit.

Manganese Content in Hundredths of 1%	f	f_e	$(f - f_e)$	$(f - f_e)^2$	$\frac{(f-f_e)^2}{f_e}$
.695 - .715	3	3.35	+.35	.1225	.03657
.715 - .735	3	4.10	+1.10	1.2100	.29512
.735 - .755	6	7.34	+1.34	1.7956	.24550
.755 - .775	10	12.21	+2.21	4.8841	.40001
.775 - .795	16	17.92	+1.92	3.6864	.20571
.795 - .815	27	22.02	−4.98	24.8004	1.12627
.815 - .835	36	25.21	−10.79	116.4241	4.61857
.835 - .855	26	24.12	−1.88	3.5344	.14653
.855 - .875	16	21.53	+5.53	30.5809	1.42076
.875 - .895	17	15.65	−1.35	1.8225	.11645
.895 - .915	8	11.32	+2.32	5.3824	.47548
.915 - .935	7	6.71	−.31	.0961	.00143
.935 and over	3	6.52	+3.52	12.3904	1.19004
	178	178.00			10.27844

degrees of Freedom
Class intervals - 13
M = .8324
σ = .0564
N = frequency = 178

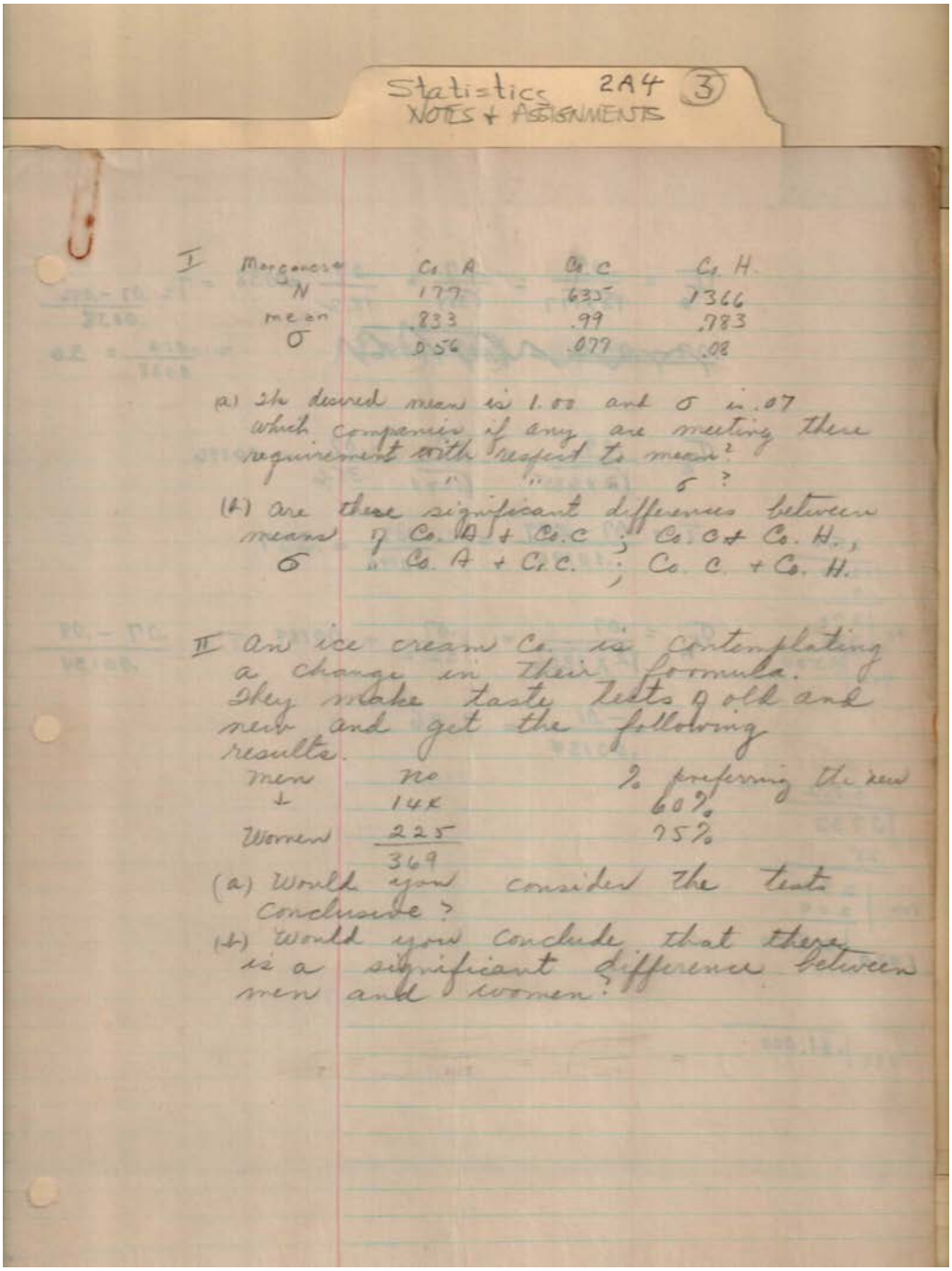
N = 13 − 3 = 10
N = 10 in table of χ^2 = 18.307 − .05 } random samples, if the
23.209 − .01 } true value of χ^2 = 0. The
value 10.27844 is not excessive.

From Table 14 for testing the goodness of fit of the observed frequencies to the theoretical frequencies it is found that when the degrees of freedom are 10 as in this case, a value of χ^2 as great as 18.307 would occur purely as a result of chance in 5 out of 100

χ^2 = 10.27844
∴ according to the chi square test this Manganese frequency curve falls well within the chance fluctuations of .05 in the goodness of fit test and it can therefore be said that this data in all probability follows the normal distribution or the normal law of error.

Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

I

Manganese	Co. A	Co. C	Co. H.
N	177	635	1366
mean	.833	.99	.783
σ	.056	.077	.08

(a) The desired mean is 1.00 and σ is .07 which companies if any are meeting these requirement with respect to mean?
" " σ?
(b) are these significant differences between means of Co. A + Co. C ; Co. C + Co. H.,
σ " Co. A + Co. C. ; Co. C. + Co. H.

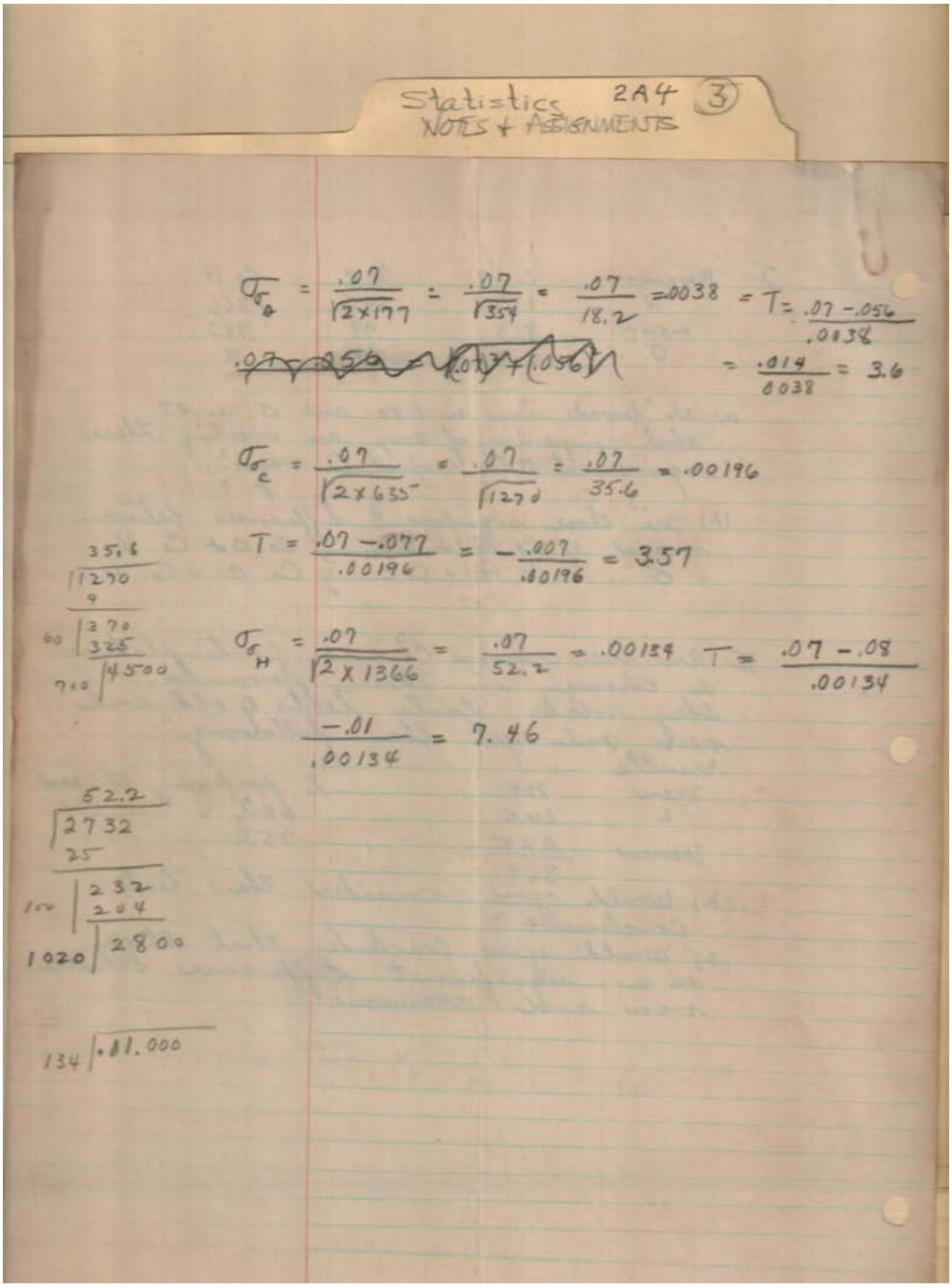
II An ice cream Co. is contemplating a change in their formula. They make taste tests of old and new and get the following results.

	no	% preferring the new
men	144	60%
Women	225	75%
	369	

(a) Would you consider the tests conclusive?
(b) Would you conclude that there is a significant difference between men and women?

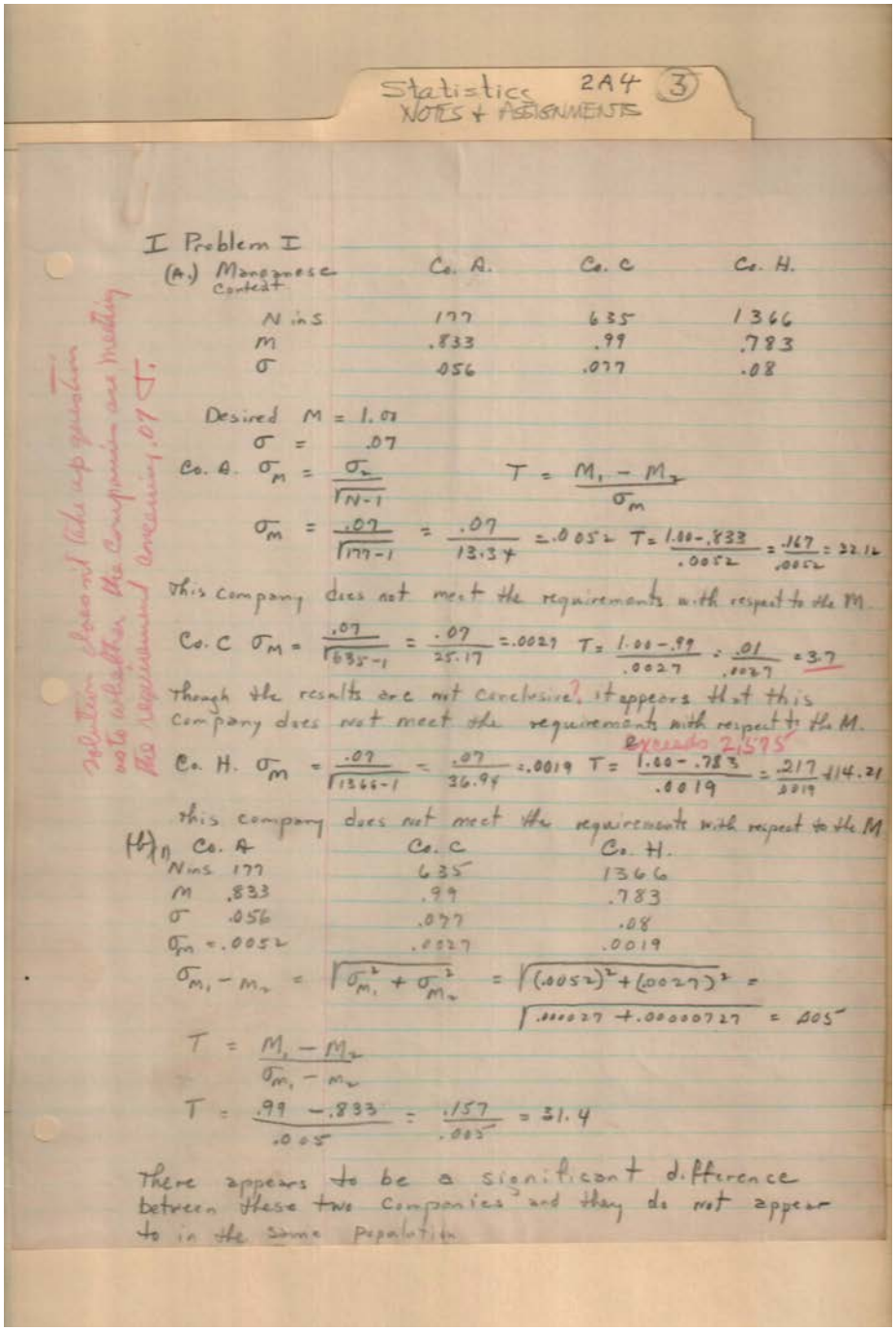
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

I Problem I

(A.) Manganese Content

	Co. A.	Co. C	Co. H.
N ins	177	635	1366
M	.833	.99	.783
σ	.056	.077	.08

Desired M = 1.01
σ = .07

Co. A. $\sigma_M = \frac{\sigma}{\sqrt{N-1}}$ $T = \frac{M_1 - M_2}{\sigma_M}$

$\sigma_M = \frac{.07}{\sqrt{177-1}} = \frac{.07}{13.34} = .0052$ $T = \frac{1.00-.833}{.0052} = \frac{.167}{.0052} = 32.12$

This company does not meet the requirements with respect to the M.

Co. C $\sigma_M = \frac{.07}{\sqrt{635-1}} = \frac{.07}{25.17} = .0027$ $T = \frac{1.00-.99}{.0027} = \frac{.01}{.0027} = 3.7$

Though the results are not conclusive, it appears that this company does not meet the requirements with respect to the M.

Exceeds 2.575

Co. H. $\sigma_M = \frac{.07}{\sqrt{1366-1}} = \frac{.07}{36.94} = .0019$ $T = \frac{1.00-.783}{.0019} = \frac{.217}{.0019} = 114.21$

this company does not meet the requirements with respect to the M

(B)

	Co. A	Co. C	Co. H.
Nins	177	635	1366
M	.833	.99	.783
σ	.056	.077	.08
σ_M	.0052	.0027	.0019

$\sigma_{M_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2} = \sqrt{(.0052)^2 + (.0027)^2} = \sqrt{.000027 + .00000729} = .005$

$T = \frac{M_1 - M_2}{\sigma_{M_1 - M_2}}$

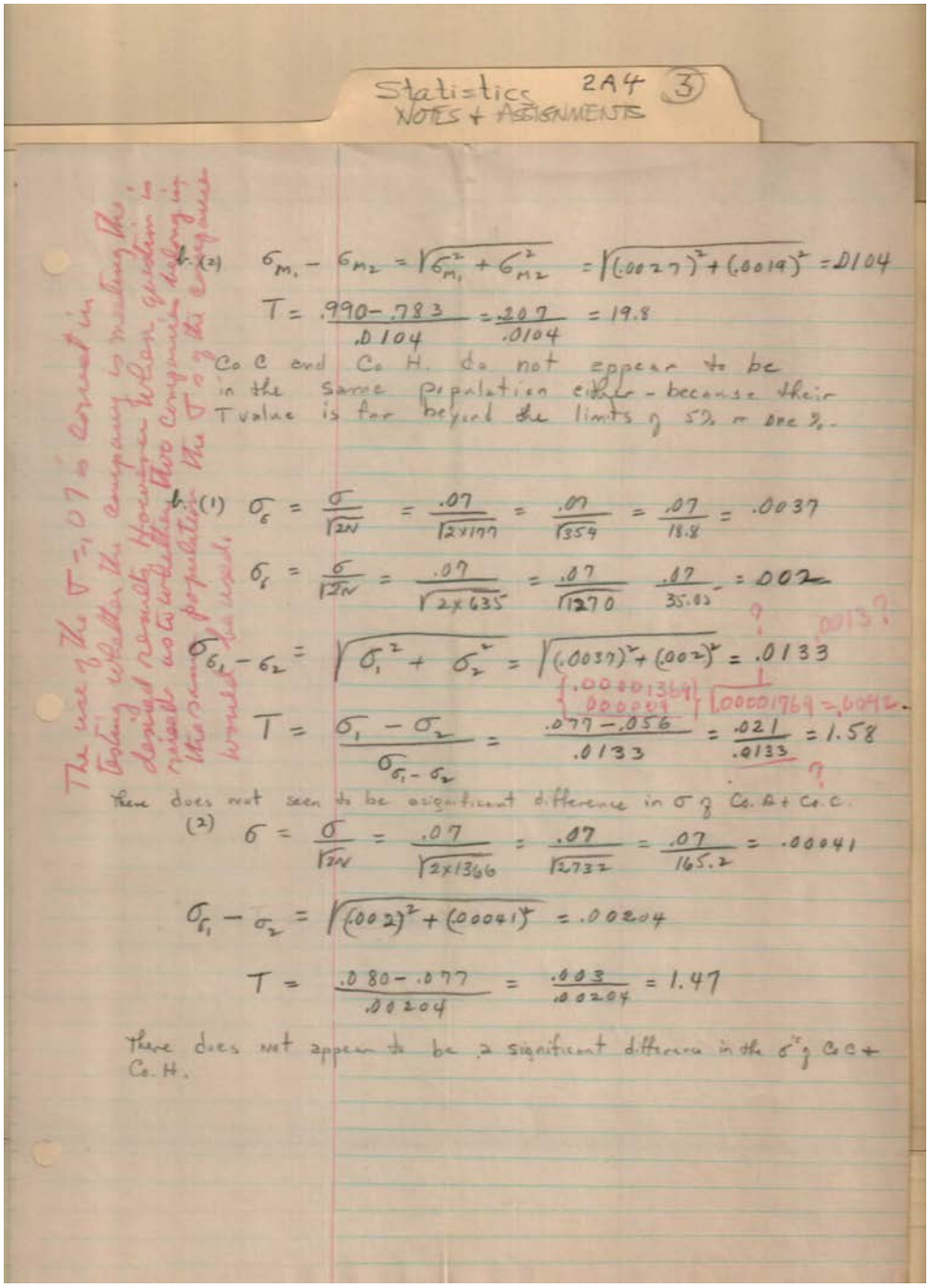
$T = \frac{.99 - .833}{.005} = \frac{.157}{.005} = 31.4$

There appears to be a significant difference between these two companies and they do not appear to in the same population

Solution chosen and takes up problem was whether the companies are meeting the requirement concerning .07 σ.

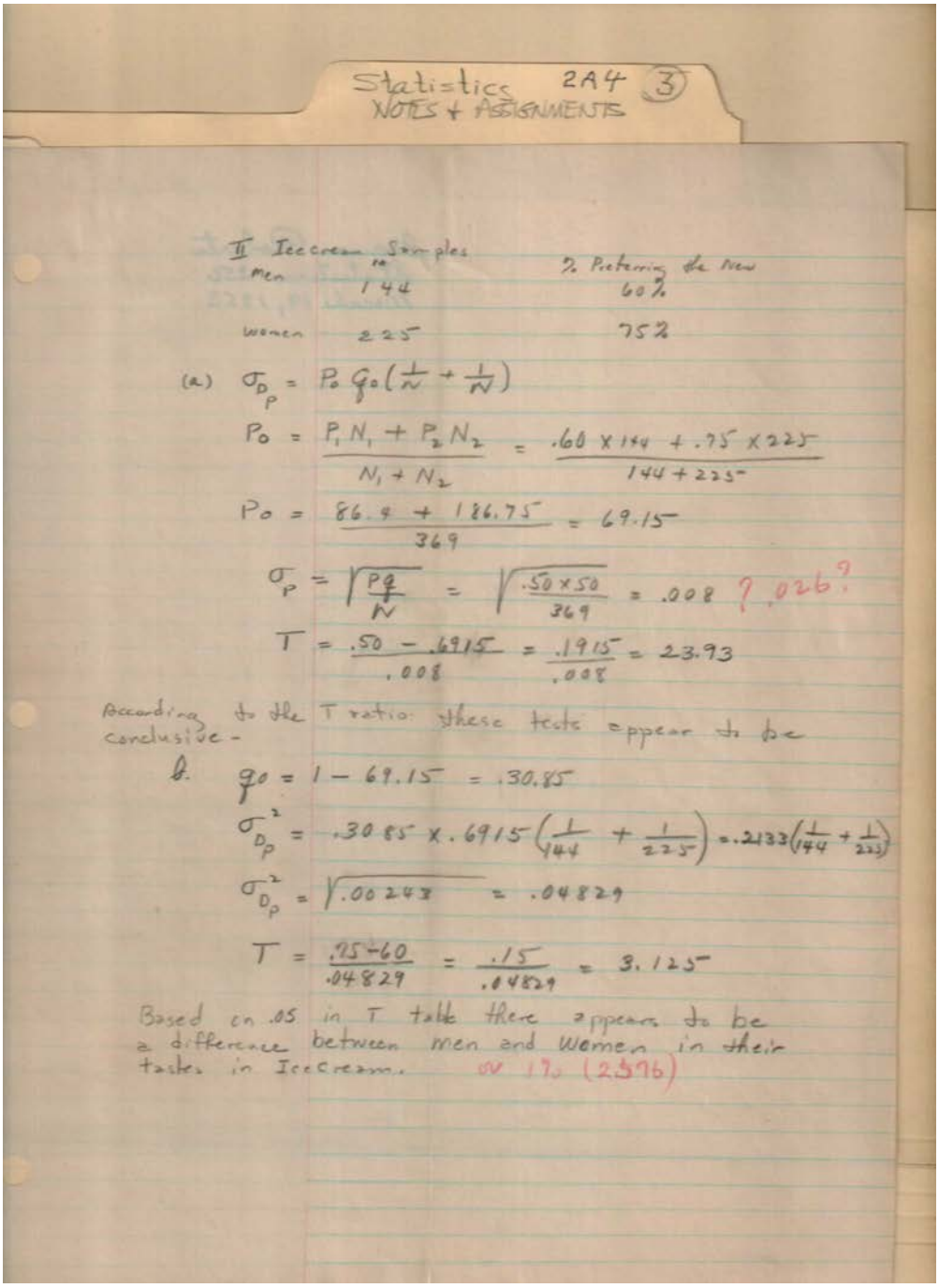
Names:
Business Statistics

Types:
notes



Names:
Business Statistics

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

II Icecream Samples

	n	% Preferring the New
Men	144	60%
Women	225	75%

(a) $\sigma_{D_p} = P_0 q_0 \left(\frac{1}{N} + \frac{1}{N}\right)$

$P_0 = \frac{P_1 N_1 + P_2 N_2}{N_1 + N_2} = \frac{.60 \times 144 + .75 \times 225}{144 + 225}$

$P_0 = \frac{86.4 + 186.75}{369} = 69.15$

$\sigma_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{.50 \times .50}{369}} = .008$? .026 ?

$T = \frac{.50 - .6915}{.008} = \frac{.1915}{.008} = 23.93$

According to the T ratio these tests appear to be conclusive -

b. $q_0 = 1 - 69.15 = .3085$

$\sigma^2_{D_p} = .3085 \times .6915 \left(\frac{1}{144} + \frac{1}{225}\right) = .2133\left(\frac{1}{144} + \frac{1}{225}\right)$

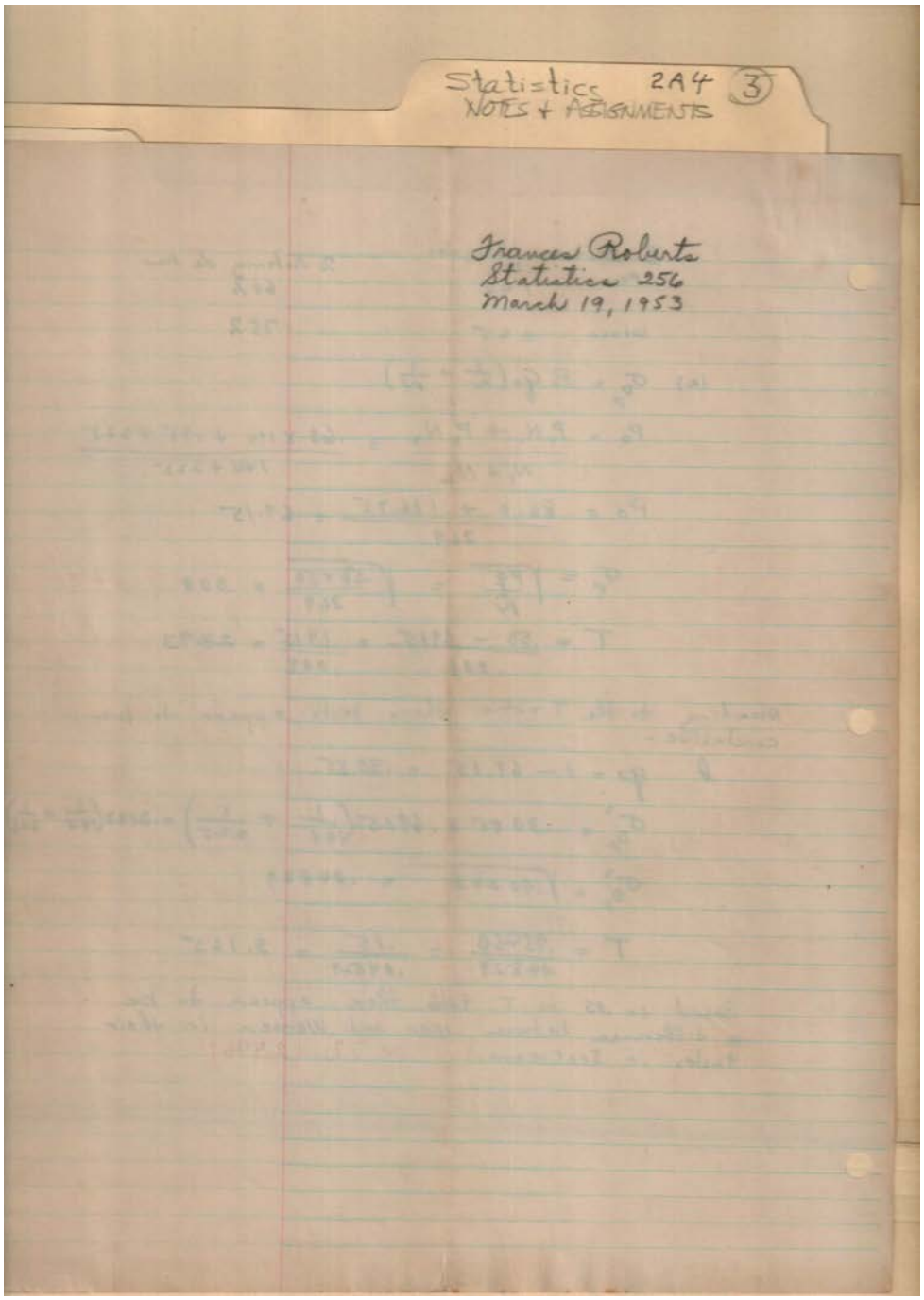
$\sigma_{D_p} = \sqrt{.00248} = .04829$

$T = \frac{.75 - .60}{.04829} = \frac{.15}{.04829} = 3.125$

Based on .05 in T table there appears to be a difference between men and women in their tastes in Icecream. or 1% (2.576)

Names:
Business Statistics

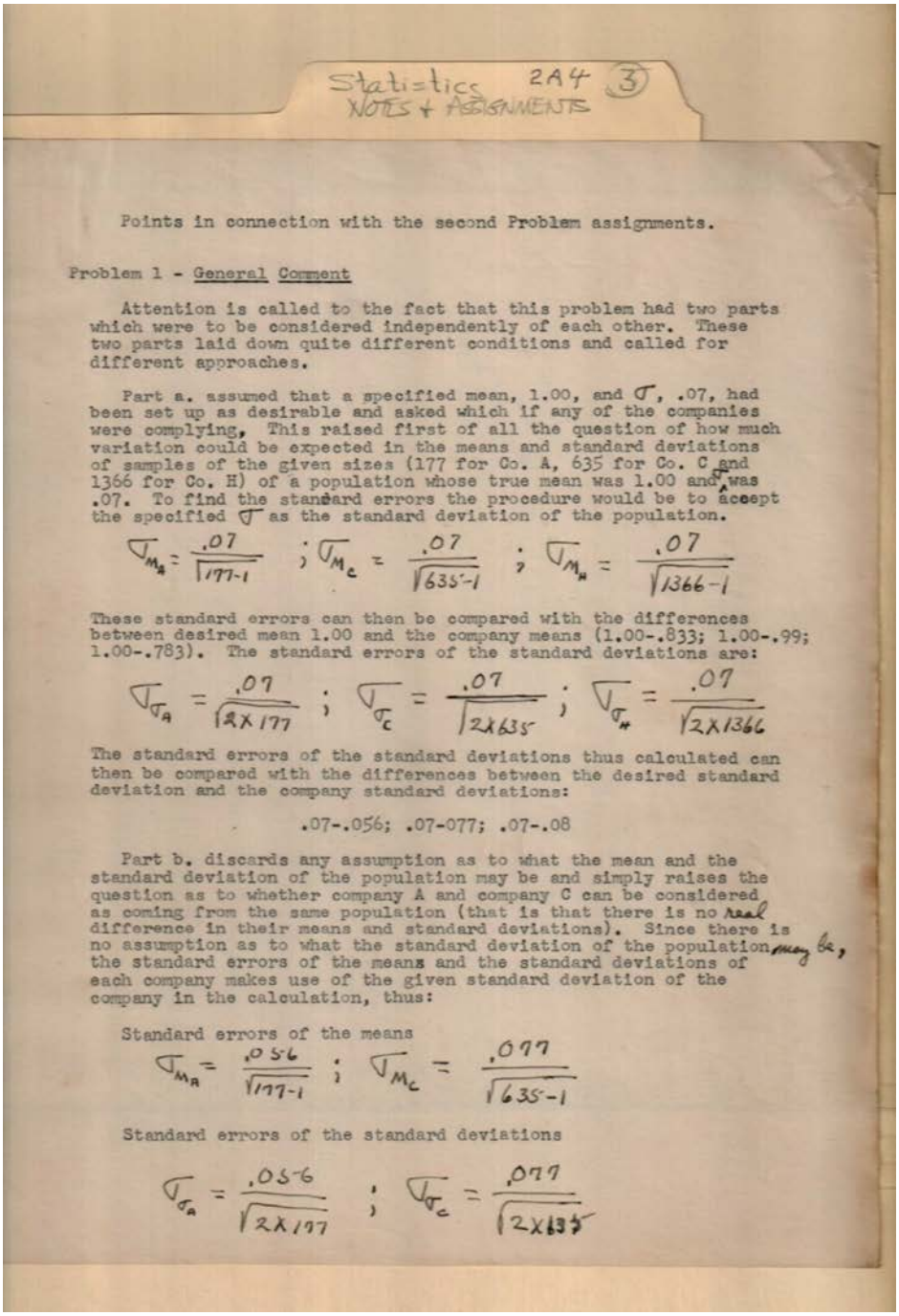
Types:
notes



Names:
Roberts, Frances

Types:
notes

Dates:
Mar 19, 1953



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Points in connection with the second Problem assignments.

Problem 1 - General Comment

Attention is called to the fact that this problem had two parts which were to be considered independently of each other. These two parts laid down quite different conditions and called for different approaches.

Part a. assumed that a specified mean, 1.00, and σ, .07, had been set up as desirable and asked which if any of the companies were complying, This raised first of all the question of how much variation could be expected in the means and standard deviations of samples of the given sizes (177 for Co. A, 635 for Co. C and 1366 for Co. H) of a population whose true mean was 1.00 and σ was .07. To find the standard errors the procedure would be to accept the specified σ as the standard deviation of the population.

$$\sigma_{M_A} = \frac{.07}{\sqrt{177-1}} \; ; \; \sigma_{M_C} = \frac{.07}{\sqrt{635-1}} \; ; \; \sigma_{M_H} = \frac{.07}{\sqrt{1366-1}}$$

These standard errors can then be compared with the differences between desired mean 1.00 and the company means (1.00-.833; 1.00-.99; 1.00-.783). The standard errors of the standard deviations are:

$$\sigma_{\sigma_A} = \frac{.07}{\sqrt{2X177}} \; ; \; \sigma_{\sigma_C} = \frac{.07}{\sqrt{2X635}} \; ; \; \sigma_{\sigma_H} = \frac{.07}{\sqrt{2X1366}}$$

The standard errors of the standard deviations thus calculated can then be compared with the differences between the desired standard deviation and the company standard deviations:

.07-.056; .07-077; .07-.08

Part b. discards any assumption as to what the mean and the standard deviation of the population may be and simply raises the question as to whether company A and company C can be considered as coming from the same population (that is that there is no real difference in their means and standard deviations). Since there is no assumption as to what the standard deviation of the population may be, the standard errors of the means and the standard deviations of each company makes use of the given standard deviation of the company in the calculation, thus:

Standard errors of the means

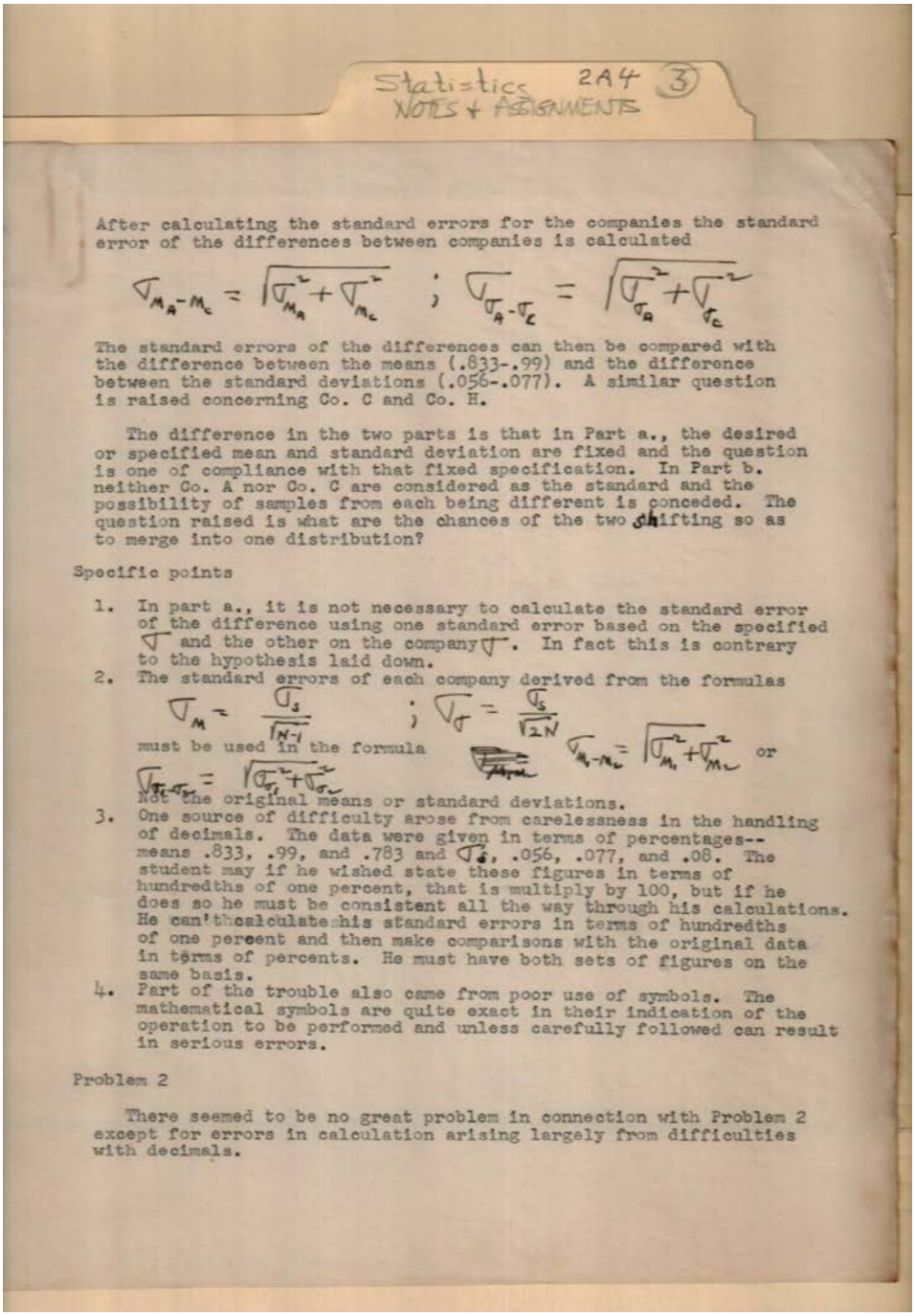
$$\sigma_{M_A} = \frac{.056}{\sqrt{177-1}} \; ; \; \sigma_{M_C} = \frac{.077}{\sqrt{635-1}}$$

Standard errors of the standard deviations

$$\sigma_{\sigma_A} = \frac{.056}{\sqrt{2X177}} \; ; \; \sigma_{\sigma_C} = \frac{.077}{\sqrt{2X635}}$$

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

After calculating the standard errors for the companies the standard error of the differences between companies is calculated

$$\sigma_{M_A - M_C} = \sqrt{\sigma_{M_A}^2 + \sigma_{M_C}^2} \quad ; \quad \sigma_{\sigma_A - \sigma_C} = \sqrt{\sigma_{\sigma_A}^2 + \sigma_{\sigma_C}^2}$$

The standard errors of the differences can then be compared with the difference between the means (.833-.99) and the difference between the standard deviations (.056-.077). A similar question is raised concerning Co. C and Co. H.

The difference in the two parts is that in Part a., the desired or specified mean and standard deviation are fixed and the question is one of compliance with that fixed specification. In Part b. neither Co. A nor Co. C are considered as the standard and the possibility of samples from each being different is conceded. The question raised is what are the chances of the two shifting so as to merge into one distribution?

Specific points

1. In part a., it is not necessary to calculate the standard error of the difference using one standard error based on the specified σ and the other on the company σ. In fact this is contrary to the hypothesis laid down.
2. The standard errors of each company derived from the formulas

$$\sigma_M = \frac{\sigma_s}{\sqrt{N-1}} \quad ; \quad \sigma_\sigma = \frac{\sigma_s}{\sqrt{2N}}$$

must be used in the formula $\sigma_{M_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$ or $\sigma_{\sigma_1 - \sigma_2} = \sqrt{\sigma_{\sigma_1}^2 + \sigma_{\sigma_2}^2}$

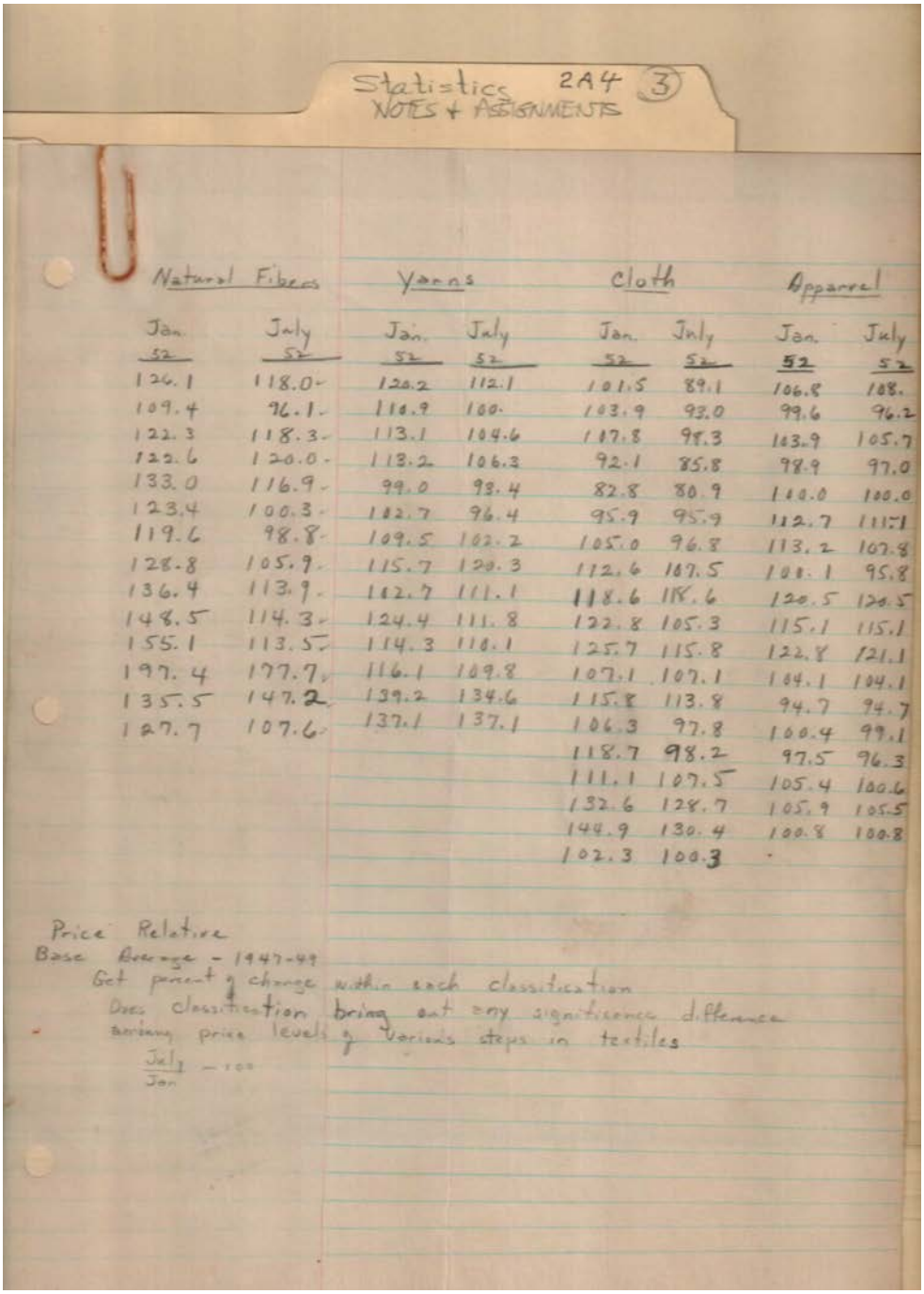
Not the original means or standard deviations.
3. One source of difficulty arose from carelessness in the handling of decimals. The data were given in terms of percentages-- means .833, .99, and .783 and σ_s, .056, .077, and .08. The student may if he wished state these figures in terms of hundredths of one percent, that is multiply by 100, but if he does so he must be consistent all the way through his calculations. He can't then calculate his standard errors in terms of hundredths of one percent and then make comparisons with the original data in terms of percents. He must have both sets of figures on the same basis.
4. Part of the trouble also came from poor use of symbols. The mathematical symbols are quite exact in their indication of the operation to be performed and unless carefully followed can result in serious errors.

Problem 2

There seemed to be no great problem in connection with Problem 2 except for errors in calculation arising largely from difficulties with decimals.

Names:
Statistical Notes

Types:
notes



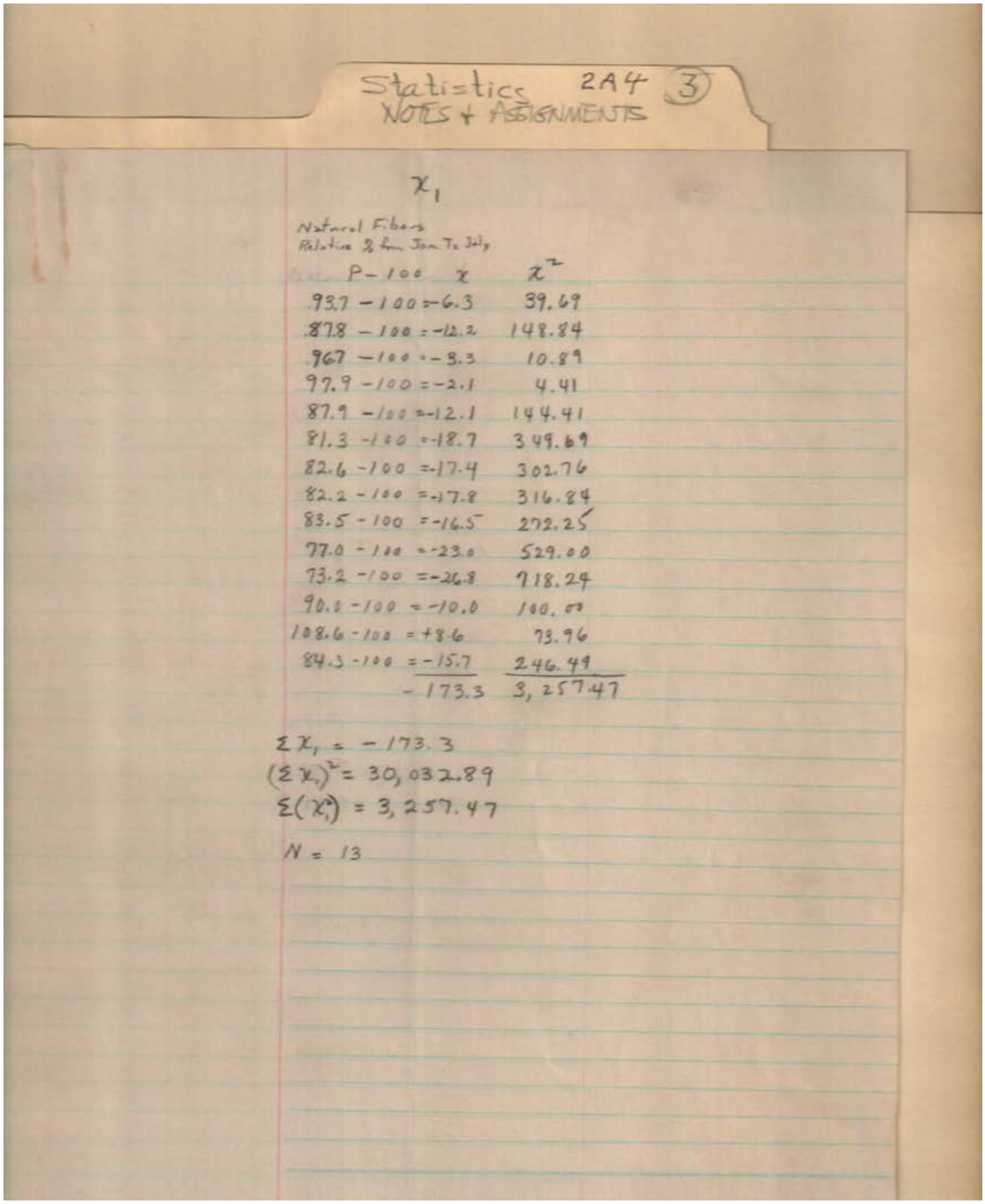
Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Natural Fibers		Yarns		Cloth		Apparel	
Jan. 52	July 52	Jan. 52	July 52	Jan. 52	July 52	Jan. 52	July 52
126.1	118.0	120.2	112.1	101.5	89.1	106.8	108.
109.4	96.1	110.9	100.	103.9	93.0	99.6	96.2
122.3	118.3	113.1	104.6	107.8	98.3	103.9	105.7
122.6	120.0	113.2	106.3	92.1	85.8	98.9	97.0
133.0	116.9	99.0	93.4	82.8	80.9	100.0	100.0
123.4	100.3	102.7	96.4	95.9	95.9	112.7	111.1
119.6	98.8	109.5	102.2	105.0	96.8	113.2	107.8
128.8	105.9	115.7	120.3	112.6	107.5	101.1	95.8
136.4	113.9	102.7	111.1	118.6	118.6	120.5	120.5
148.5	114.3	124.4	111.8	122.8	105.3	115.1	115.1
155.1	113.5	114.3	110.1	125.7	115.8	122.8	121.1
197.4	177.7	116.1	109.8	107.1	107.1	104.1	104.1
135.5	147.2	139.2	134.6	115.8	113.8	94.7	94.7
127.7	107.6	137.1	137.1	106.3	97.8	100.4	99.1
				118.7	98.2	97.5	96.3
				111.1	107.5	105.4	100.6
				132.6	128.7	105.9	105.5
				144.9	130.4	100.8	100.8
				102.3	100.3		

Price Relative
Base Average - 1947-49
Get percent of change within each classification
Does classification bring out any significance difference
earning price levels of various steps in textiles
July / Jan = 100

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

X_1

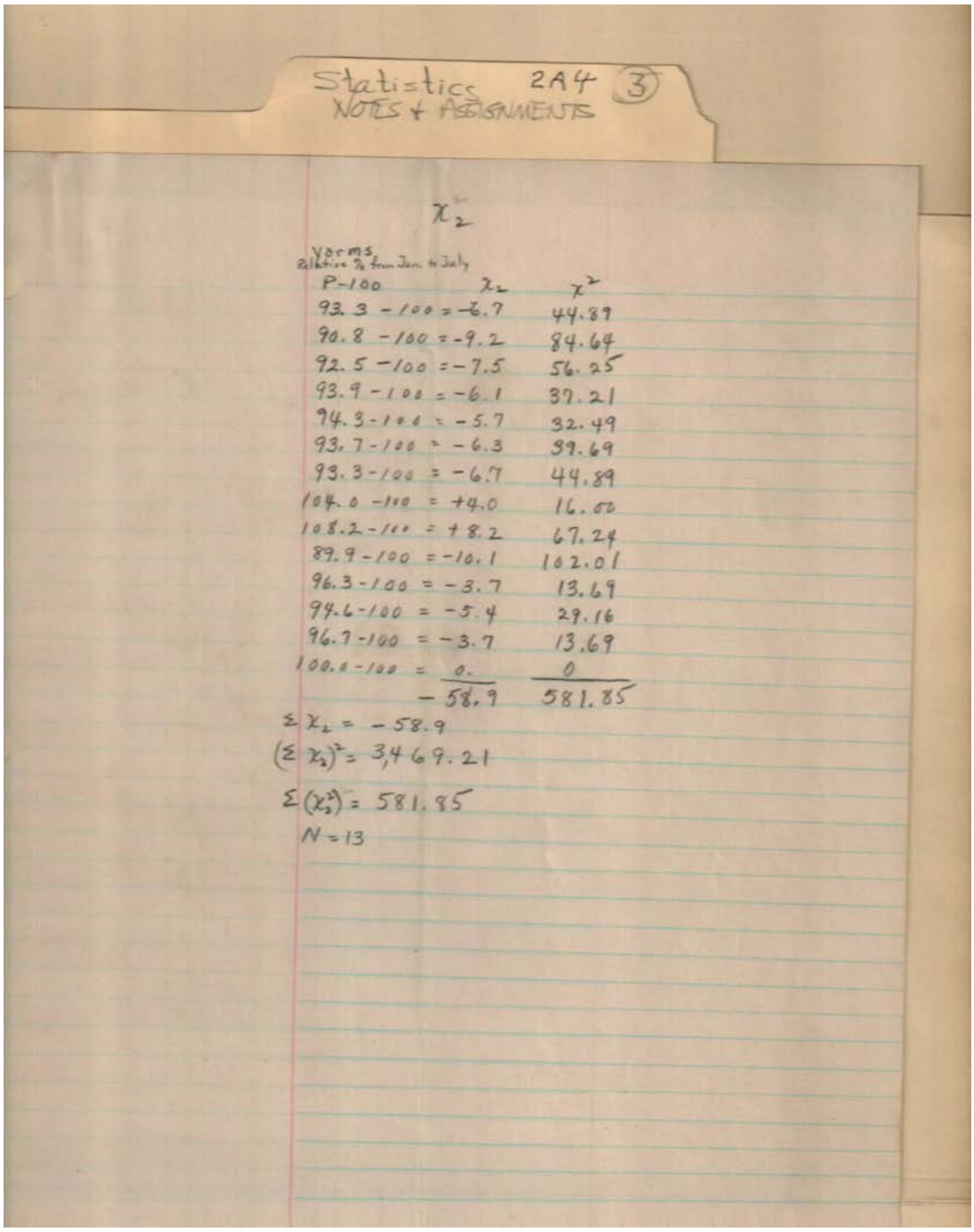
Natural Fibers
Relative % from Jan. To July

P-100	x	x^2
93.7 − 100	= −6.3	39.69
87.8 − 100	= −12.2	148.84
96.7 − 100	= −3.3	10.89
97.9 − 100	= −2.1	4.41
87.9 − 100	= −12.1	144.41
81.3 − 100	= −18.7	349.69
82.6 − 100	= −17.4	302.76
82.2 − 100	= −17.8	316.84
83.5 − 100	= −16.5	272.25
77.0 − 100	= −23.0	529.00
73.2 − 100	= −26.8	718.24
90.0 − 100	= −10.0	100.00
108.6 − 100	= +8.6	73.96
84.3 − 100	= −15.7	246.49
	−173.3	3,257.47

$\Sigma X_i = -173.3$
$(\Sigma X_i)^2 = 30,032.89$
$\Sigma(X_i^2) = 3,257.47$
$N = 13$

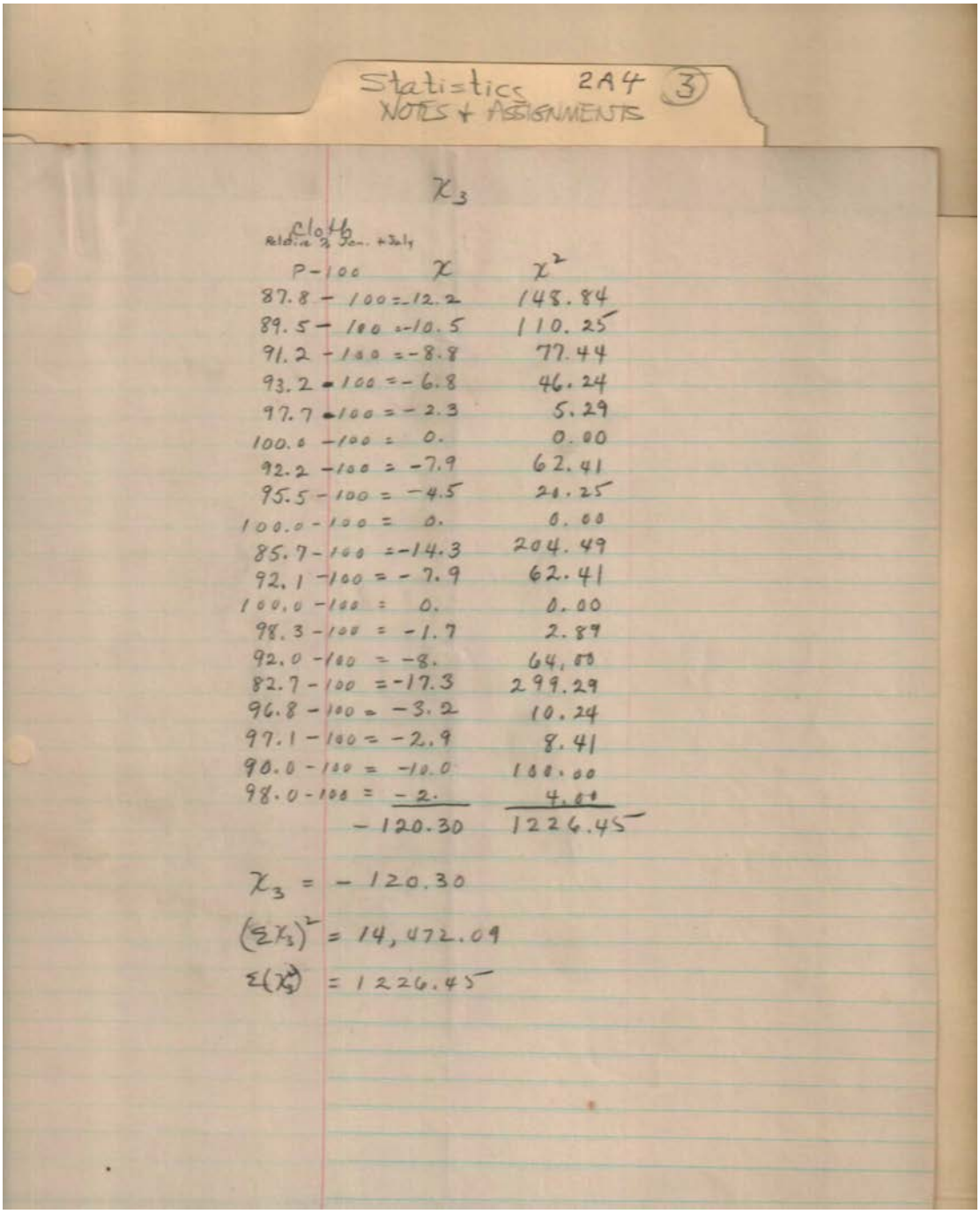
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

χ_3

Relative % Cons. Cloth

P-100	χ	χ^2
87.8 - 100	= -12.2	148.84
89.5 - 100	= -10.5	110.25
91.2 - 100	= -8.8	77.44
93.2 - 100	= -6.8	46.24
97.7 - 100	= -2.3	5.29
100.0 - 100	= 0.	0.00
92.2 - 100	= -7.9	62.41
95.5 - 100	= -4.5	20.25
100.0 - 100	= 0.	0.00
85.7 - 100	= -14.3	204.49
92.1 - 100	= -7.9	62.41
100.0 - 100	= 0.	0.00
98.3 - 100	= -1.7	2.89
92.0 - 100	= -8.	64.00
82.7 - 100	= -17.3	299.29
96.8 - 100	= -3.2	10.24
97.1 - 100	= -2.9	8.41
90.0 - 100	= -10.0	100.00
98.0 - 100	= -2.	4.00
	-120.30	1226.45

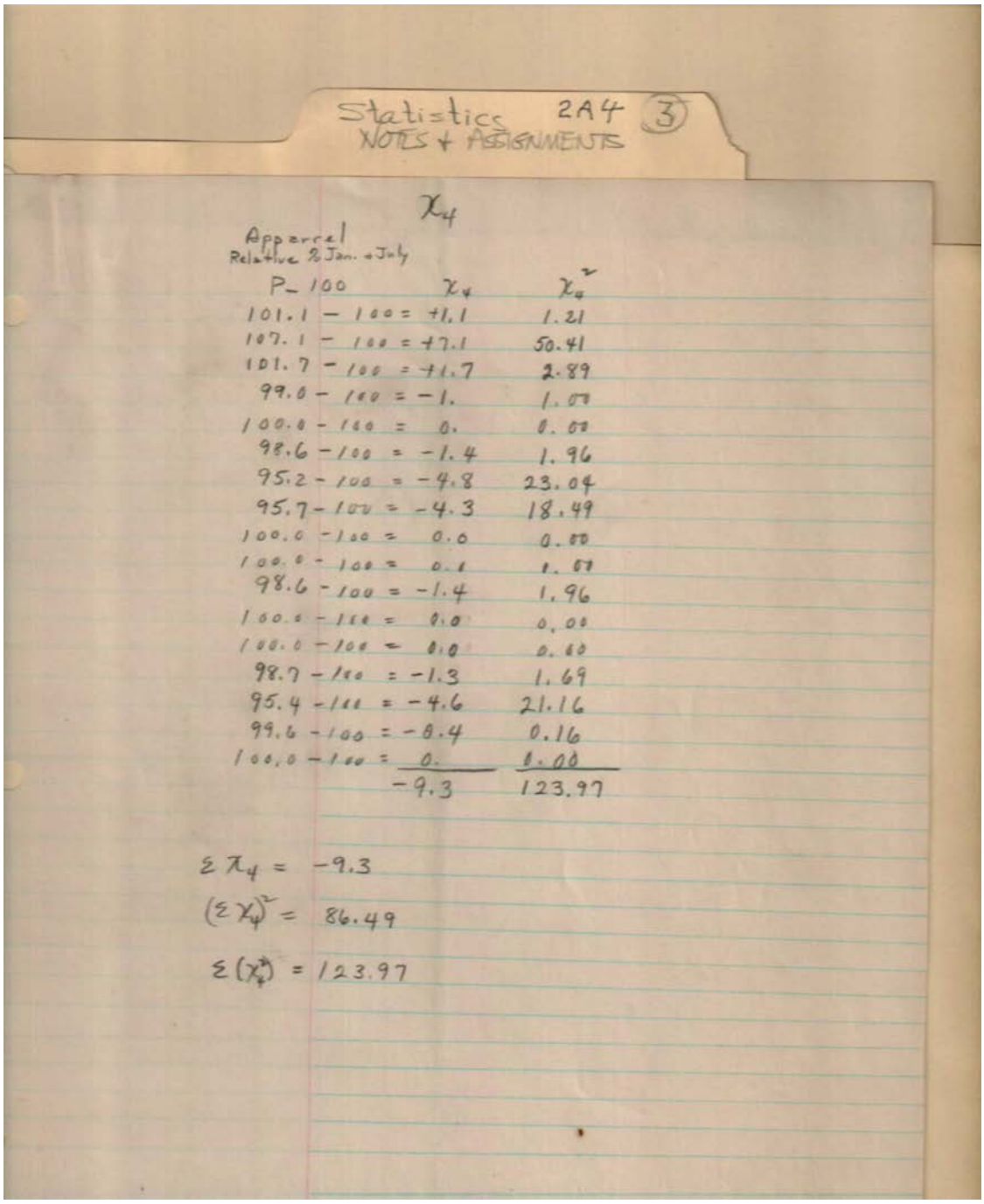
$\chi_3 = -120.30$

$(\Sigma \chi_3)^2 = 14,472.09$

$\Sigma(\chi_3^2) = 1226.45$

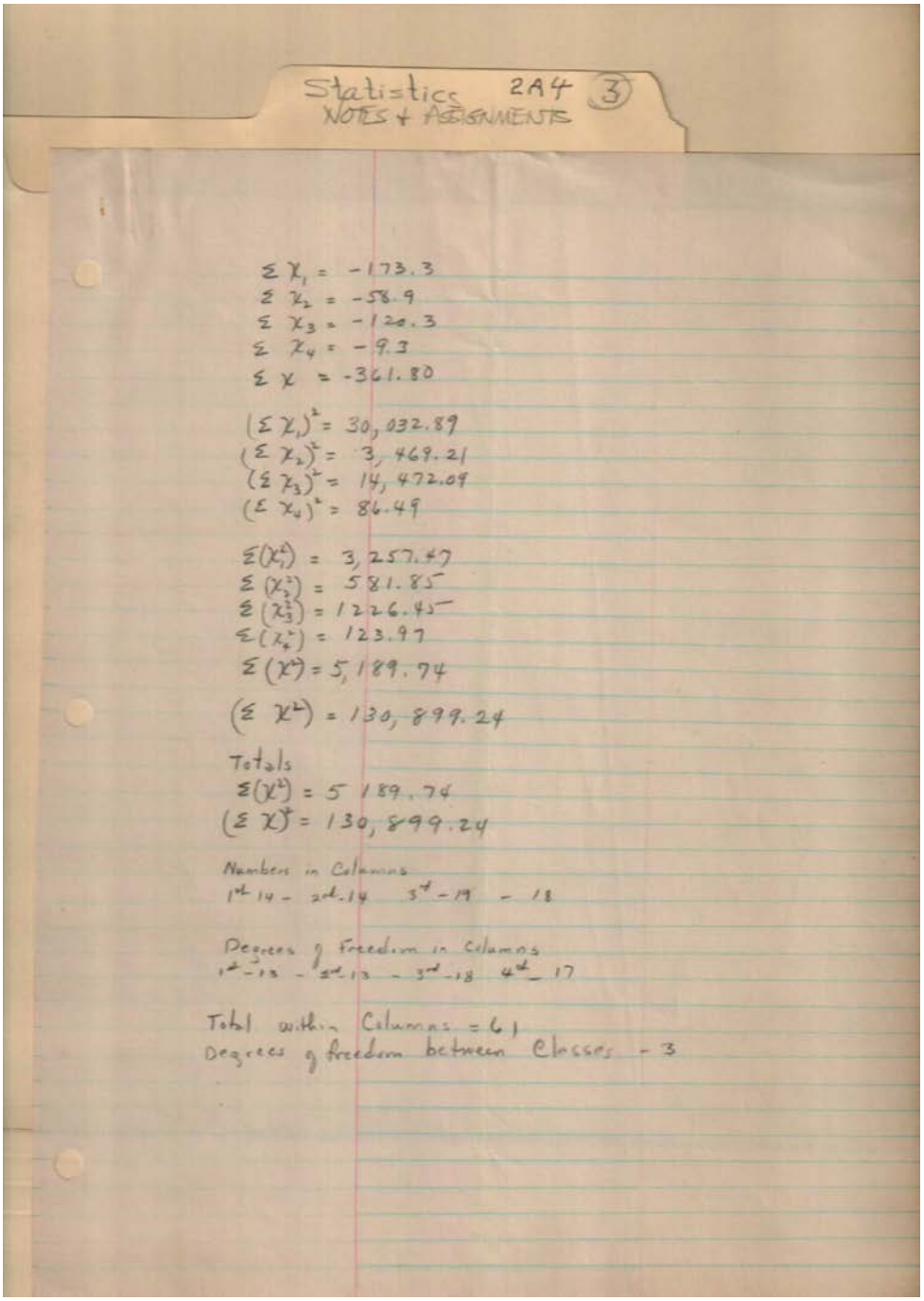
Names:
Statistical Notes

Types:
notes



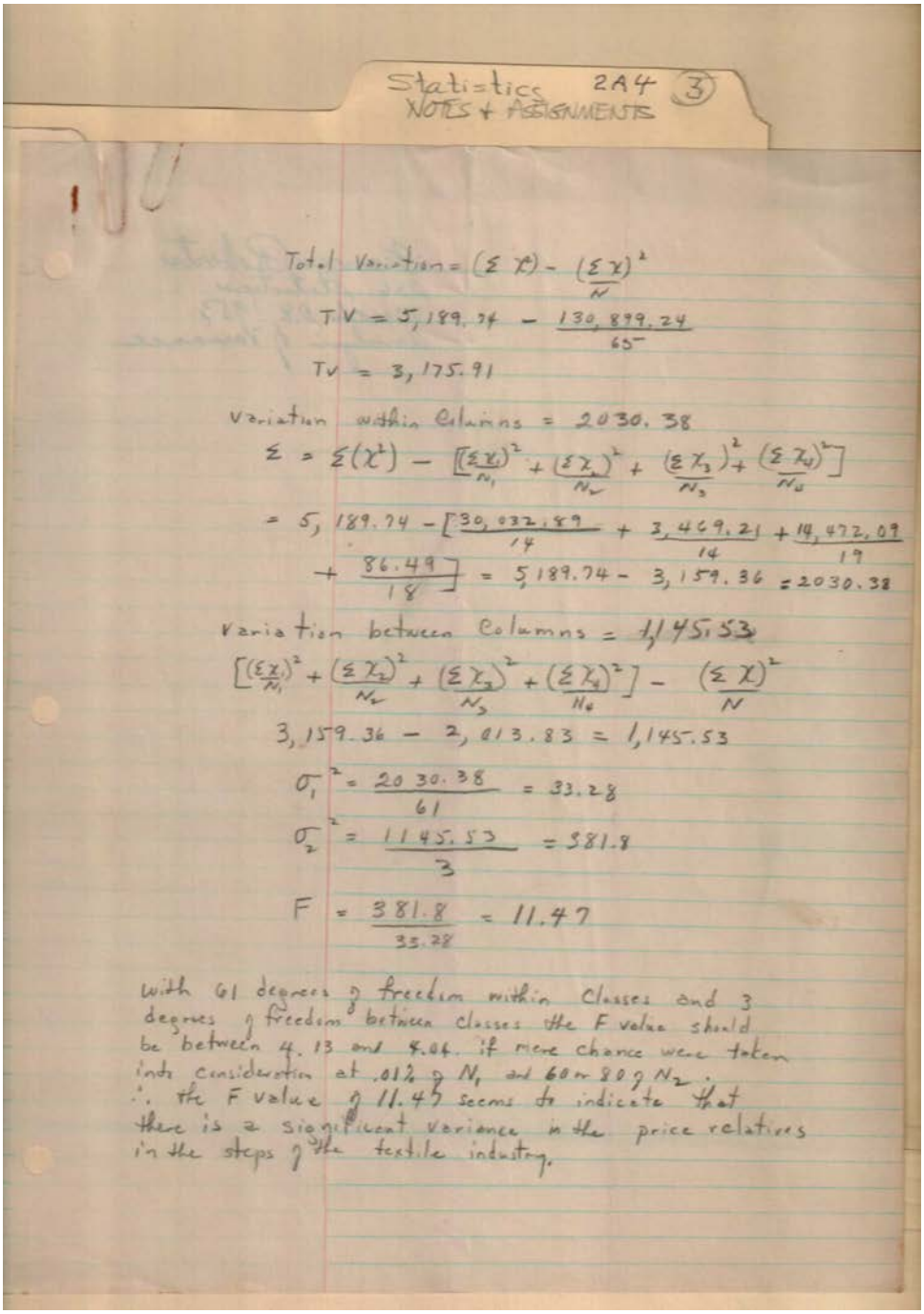
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Total Variation = $(\Sigma X^2) - \frac{(\Sigma X)^2}{N}$

$TV = 5,189.74 - \frac{130,899.24}{65}$

$TV = 3,175.91$

Variation within columns = 2030.38

$\Sigma = \Sigma(X^2) - \left[\frac{(\Sigma X_1)^2}{N_1} + \frac{(\Sigma X_2)^2}{N_2} + \frac{(\Sigma X_3)^2}{N_3} + \frac{(\Sigma X_4)^2}{N_4}\right]$

$= 5,189.74 - \left[\frac{30,032.89}{14} + \frac{3,469.21}{14} + \frac{14,472.09}{19} + \frac{86.49}{18}\right] = 5,189.74 - 3,159.36 = 2030.38$

Variation between columns = 1,145.53

$\left[\frac{(\Sigma X_1)^2}{N_1} + \frac{(\Sigma X_2)^2}{N_2} + \frac{(\Sigma X_3)^2}{N_3} + \frac{(\Sigma X_4)^2}{N_4}\right] - \frac{(\Sigma X)^2}{N}$

$3,159.36 - 2,013.83 = 1,145.53$

$\sigma_1^2 = \frac{2030.38}{61} = 33.28$

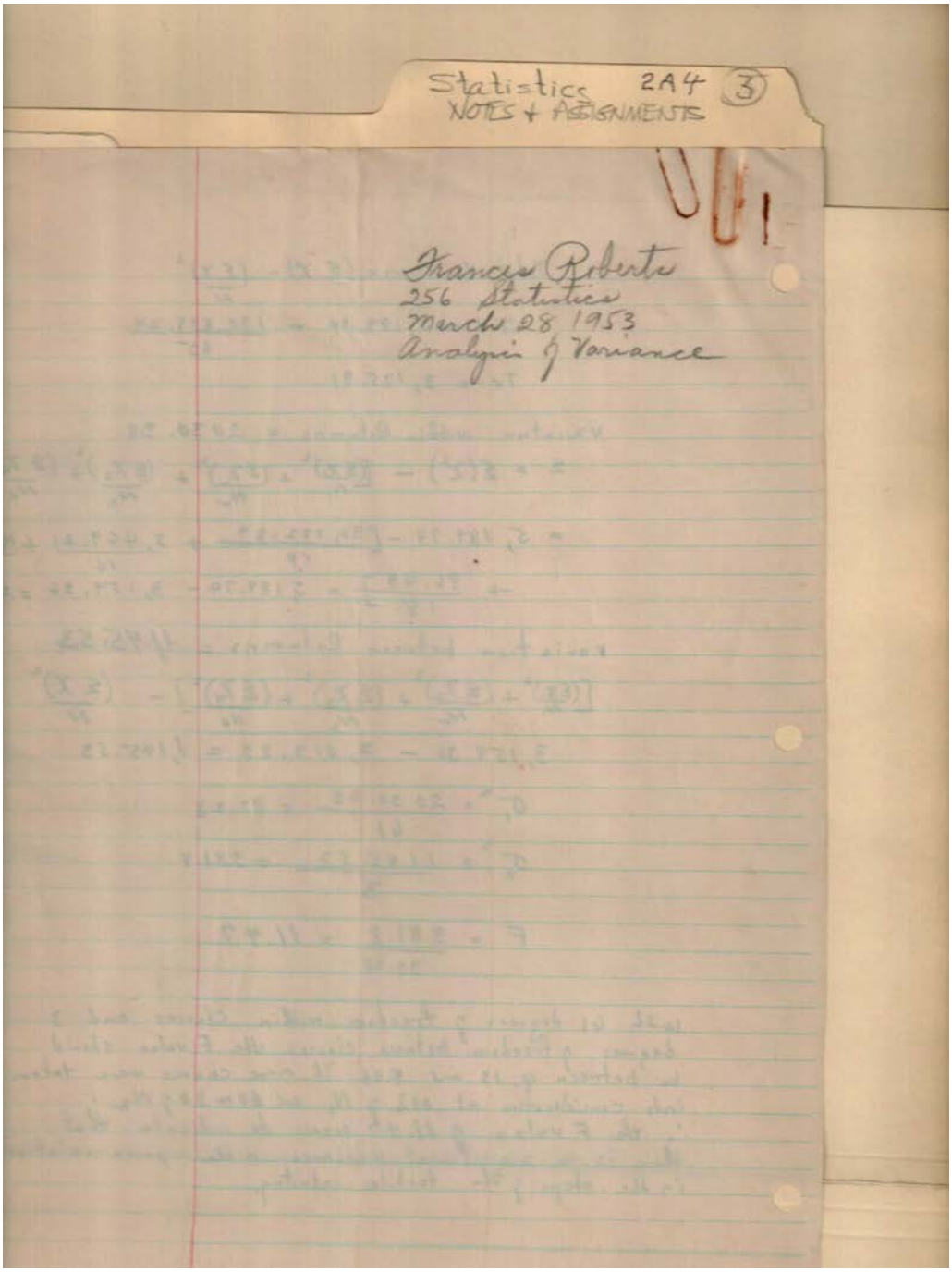
$\sigma_2^2 = \frac{1145.53}{3} = 381.8$

$F = \frac{381.8}{33.28} = 11.47$

with 61 degrees of freedom within classes and 3 degrees of freedom between classes the F value should be between 4.13 and 8.04. if mere chance were taken into consideration at .01% of N_1 and 60 or 80 of N_2.
∴ the F value of 11.47 seems to indicate that there is a significant variance in the price relatives in the steps of the textile industry.

Names:
Statistical Notes

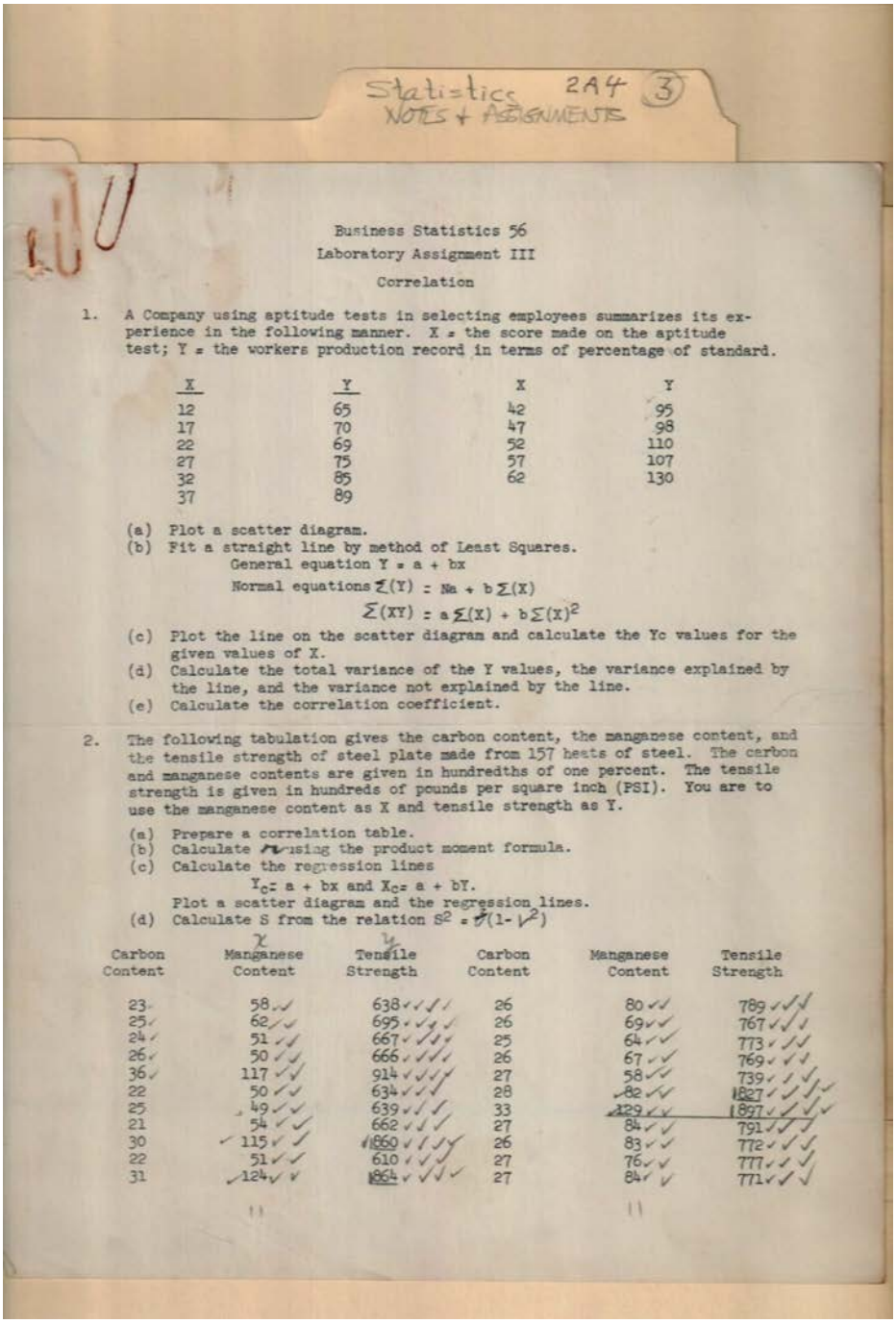
Types:
notes



Names:
Roberts, Frances

Types:
notes

Dates:
Mar 28, 1953



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Business Statistics 56
Laboratory Assignment III

Correlation

1. A Company using aptitude tests in selecting employees summarizes its experience in the following manner. X = the score made on the aptitude test; Y = the workers production record in terms of percentage of standard.

X	Y	X	Y
12	65	42	95
17	70	47	98
22	69	52	110
27	75	57	107
32	85	62	130
37	89		

(a) Plot a scatter diagram.
(b) Fit a straight line by method of Least Squares.
General equation $Y = a + bx$
Normal equations $\Sigma(Y) = Na + b\Sigma(X)$
$\Sigma(XY) = a\Sigma(X) + b\Sigma(X)^2$
(c) Plot the line on the scatter diagram and calculate the Yc values for the given values of X.
(d) Calculate the total variance of the Y values, the variance explained by the line, and the variance not explained by the line.
(e) Calculate the correlation coefficient.

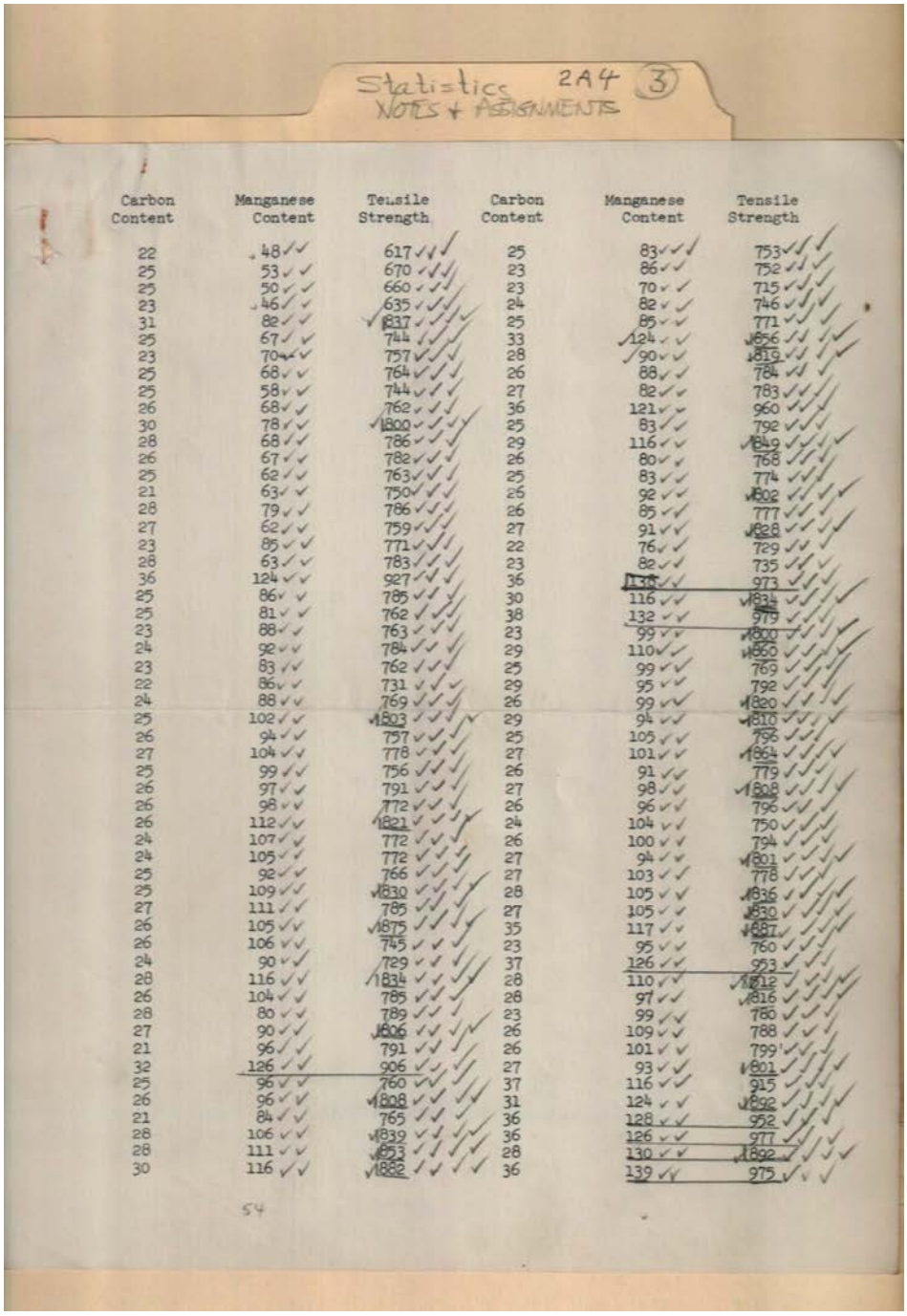
2. The following tabulation gives the carbon content, the manganese content, and the tensile strength of steel plate made from 157 heats of steel. The carbon and manganese contents are given in hundredths of one percent. The tensile strength is given in hundreds of pounds per square inch (PSI). You are to use the manganese content as X and tensile strength as Y.

(a) Prepare a correlation table.
(b) Calculate r using the product moment formula.
(c) Calculate the regression lines
$Y_c = a + bx$ and $X_c = a + bY$.
Plot a scatter diagram and the regression lines.
(d) Calculate S from the relation $S^2 = \sigma^2(1-r^2)$

Carbon Content	Manganese Content (X)	Tensile Strength (Y)	Carbon Content	Manganese Content	Tensile Strength
23	58	638	26	80	789
25	62	695	26	69	767
24	51	667	25	64	773
26	50	666	26	67	769
36	117	914	27	58	739
22	50	634	28	82	827
25	49	639	33	129	897
21	54	662	27	84	791
30	115	860	26	83	772
22	51	610	27	76	777
31	124	864	27	84	771

Names:
Statistical Notes

Types:
notes



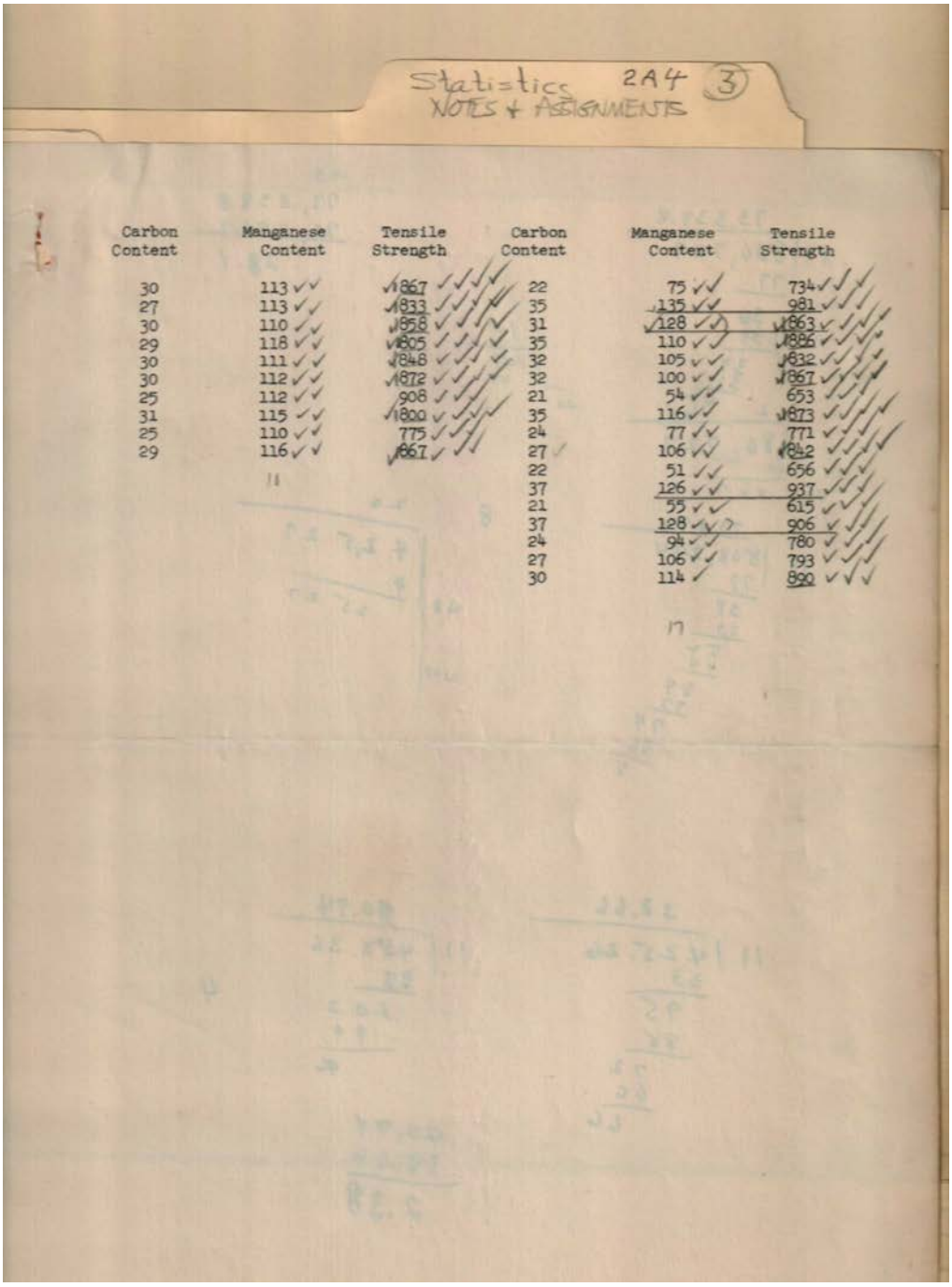
Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Carbon Content	Manganese Content	Tensile Strength	Carbon Content	Manganese Content	Tensile Strength
22	48	617	25	83	753
25	53	670	23	86	752
25	50	660	23	70	715
23	46	635	24	82	746
31	82	837	25	85	771
25	67	744	33	124	856
23	70	757	28	90	819
25	68	764	26	88	784
25	58	744	27	82	783
26	68	762	36	121	960
30	78	1800	25	83	792
28	68	786	29	116	849
26	67	782	26	80	768
25	62	763	25	83	774
21	63	750	26	92	802
28	79	786	26	85	777
27	62	759	27	91	828
23	85	771	22	76	729
28	63	783	23	82	735
36	124	927	36	136	973
25	86	785	30	116	834
25	81	762	38	132	979
23	88	763	23	99	800
24	92	784	29	110	860
23	83	762	25	99	769
22	86	731	29	95	792
24	88	769	26	99	820
25	102	1803	29	94	810
26	94	757	25	105	796
27	104	778	27	101	864
25	99	756	26	91	779
26	97	791	27	98	808
26	98	772	26	96	796
26	112	1821	24	104	750
24	107	772	26	100	794
24	105	772	27	94	801
25	92	766	27	103	778
25	109	1830	28	105	836
27	111	785	27	105	830
26	105	1875	35	117	887
26	106	745	23	95	760
24	90	729	37	126	953
28	116	1834	28	110	1812
26	104	785	28	97	816
28	80	789	23	99	780
27	90	1806	26	109	788
21	96	791	26	101	799
32	126	906	27	93	801
25	96	760	37	116	915
26	96	1808	31	124	892
21	84	765	36	128	952
28	106	1839	36	126	977
28	111	1853	28	130	1892
30	116	1882	36	139	975

54

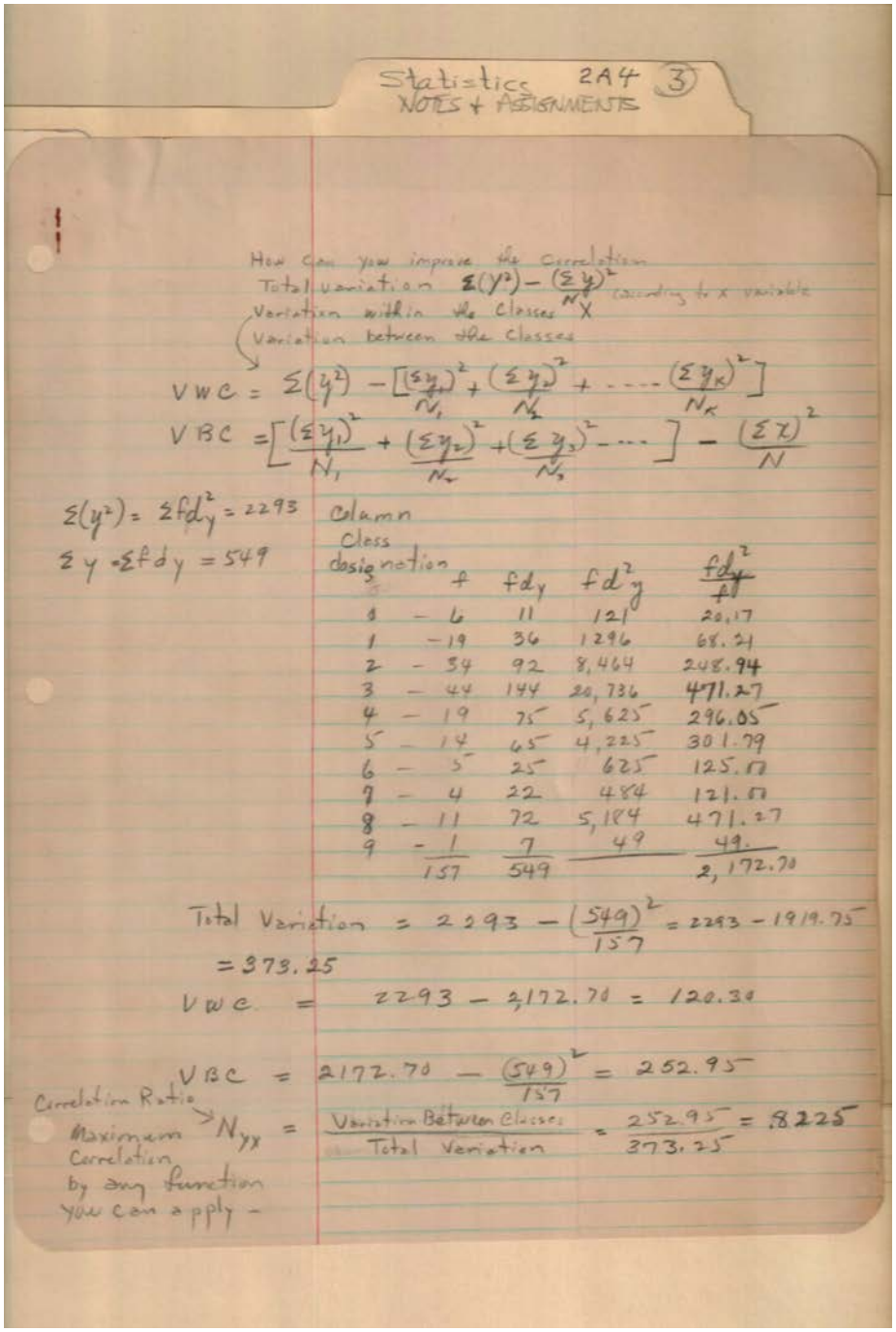
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

How can you improve the correlation
Total variation $\Sigma(y^2) - \frac{(\Sigma y)^2}{N}$ according to x variable
Variation within the classes
Variation between the classes

$$VWC = \Sigma(y^2) - \left[\frac{(\Sigma y_1)^2}{N_1} + \frac{(\Sigma y_2)^2}{N_2} + \cdots \frac{(\Sigma y_K)^2}{N_K}\right]$$

$$VBC = \left[\frac{(\Sigma y_1)^2}{N_1} + \frac{(\Sigma y_2)^2}{N_2} + \frac{(\Sigma y_3)^2}{N_3} \cdots\right] - \frac{(\Sigma x)^2}{N}$$

$\Sigma(y^2) = \Sigma f d_y^2 = 2293$
$\Sigma y = \Sigma f d_y = 549$

Class designation		f	fd_y	fd^2_y	$\frac{fd_y^2}{f}$
0	–	6	11	121	20.17
1	–	19	36	1296	68.21
2	–	34	92	8,464	248.94
3	–	44	144	20,736	471.27
4	–	19	75	5,625	296.05
5	–	14	65	4,225	301.79
6	–	5	25	625	125.00
7	–	4	22	484	121.00
8	–	11	72	5,184	471.27
9	–	1	7	49	49.
		157	549		2,172.70

Total Variation $= 2293 - \frac{(549)^2}{157} = 2293 - 1919.75 = 373.25$

$VWC = 2293 - 2,172.70 = 120.30$

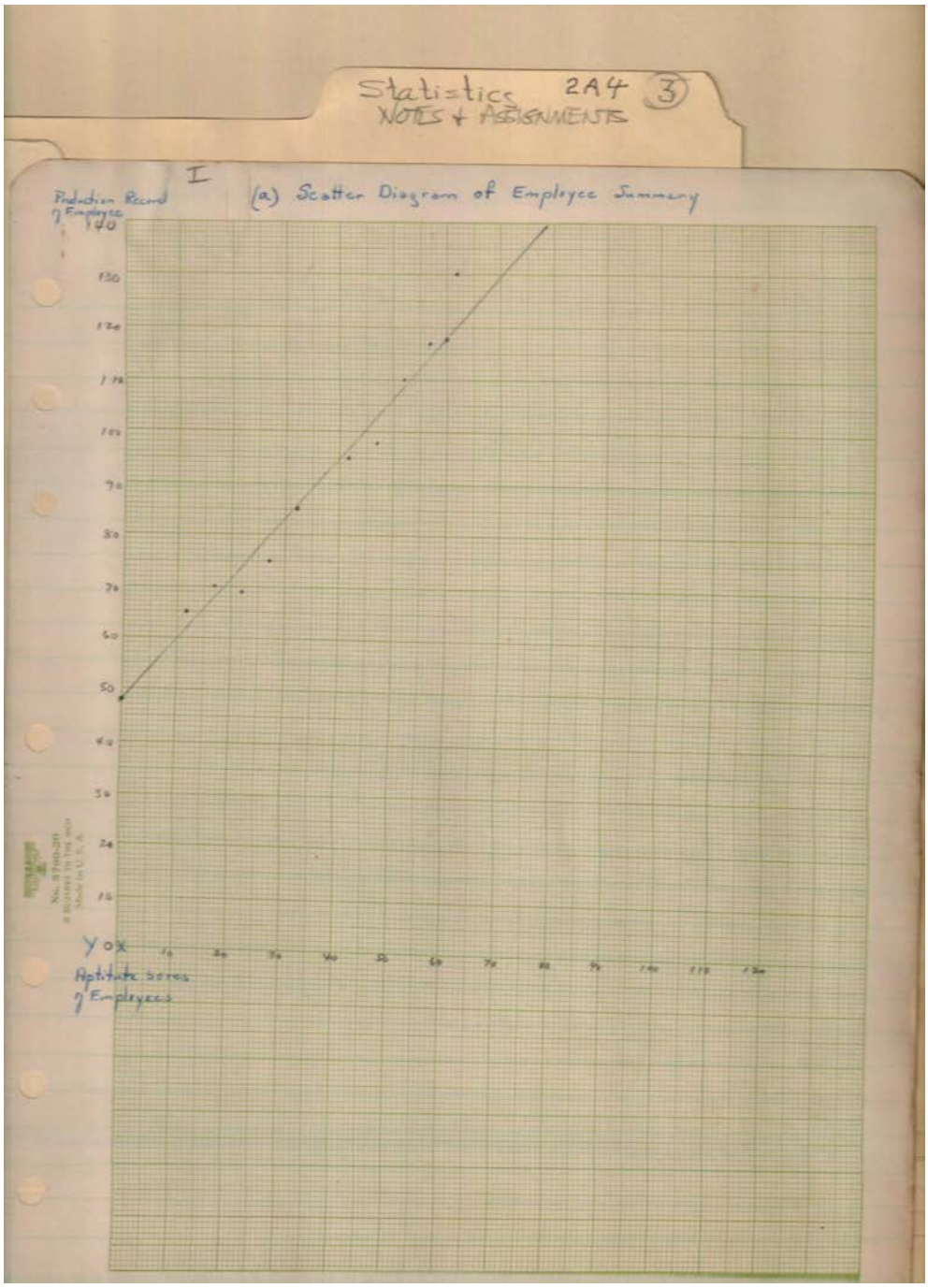
$VBC = 2172.70 - \frac{(549)^2}{157} = 252.95$

Correlation Ratio → $N_{yx} = \frac{\text{Variation Between Classes}}{\text{Total Variation}} = \frac{252.95}{373.25} = .8225$

Maximum Correlation by any function you can apply –

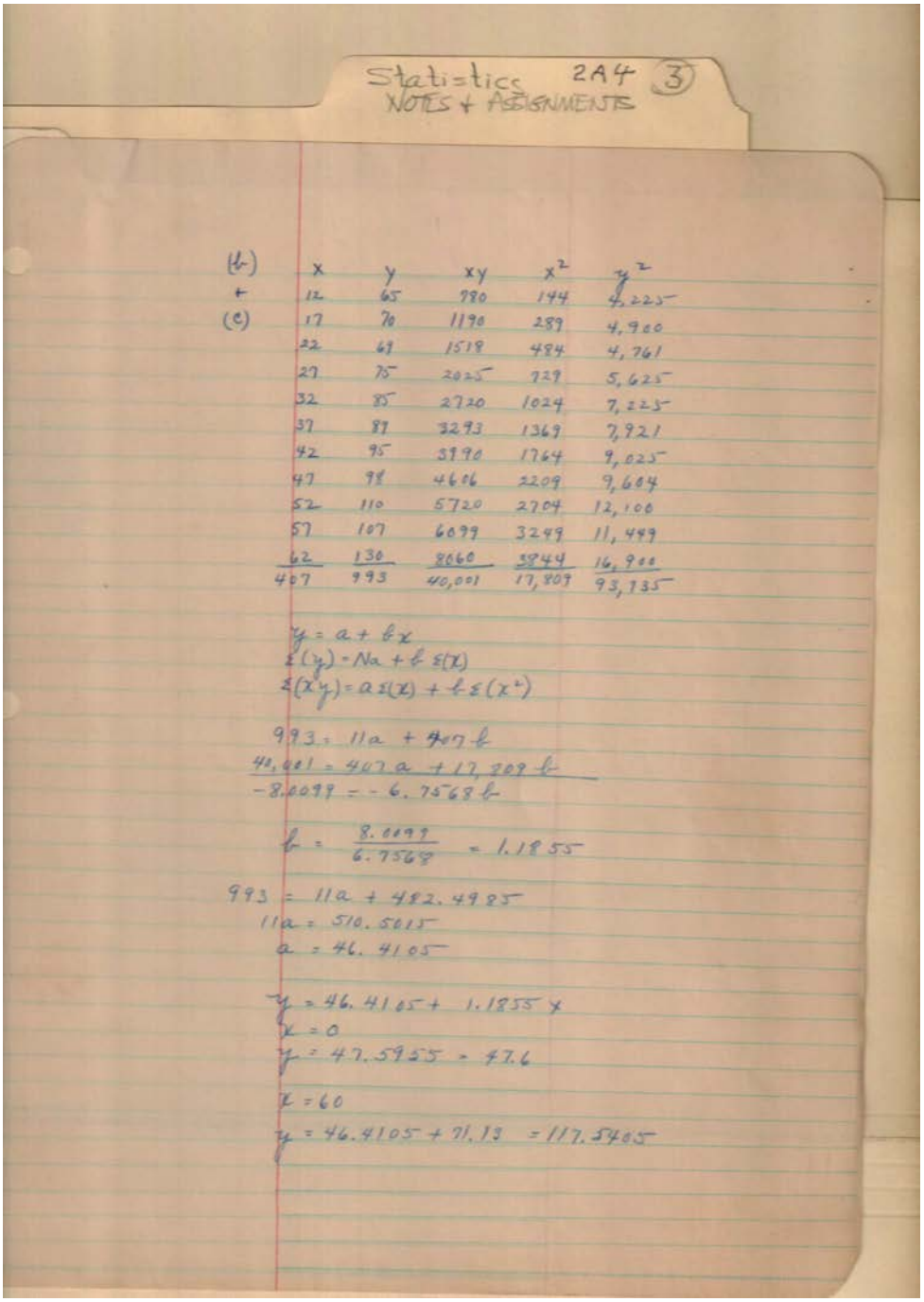
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



(b)

x	y	xy	x^2	y^2
12	65	780	144	4,225
17	70	1190	289	4,900
22	69	1518	484	4,761
27	75	2025	729	5,625
32	85	2720	1024	7,225
37	89	3293	1369	7,921
42	95	3990	1764	9,025
47	98	4606	2209	9,604
52	110	5720	2704	12,100
57	107	6099	3249	11,449
62	130	8060	3844	16,900
407	993	40,001	17,809	93,735

(c)

$y = a + bx$

$\Sigma(y) = Na + b\Sigma(x)$

$\Sigma(xy) = a\Sigma(x) + b\Sigma(x^2)$

$993 = 11a + 407b$

$40,001 = 407a + 17,809b$

$-8.0099 = -6.7568b$

$b = \frac{8.0099}{6.7568} = 1.1855$

$993 = 11a + 482.4985$

$11a = 510.5015$

$a = 46.4105$

$y = 46.4105 + 1.1855x$

$x = 0$

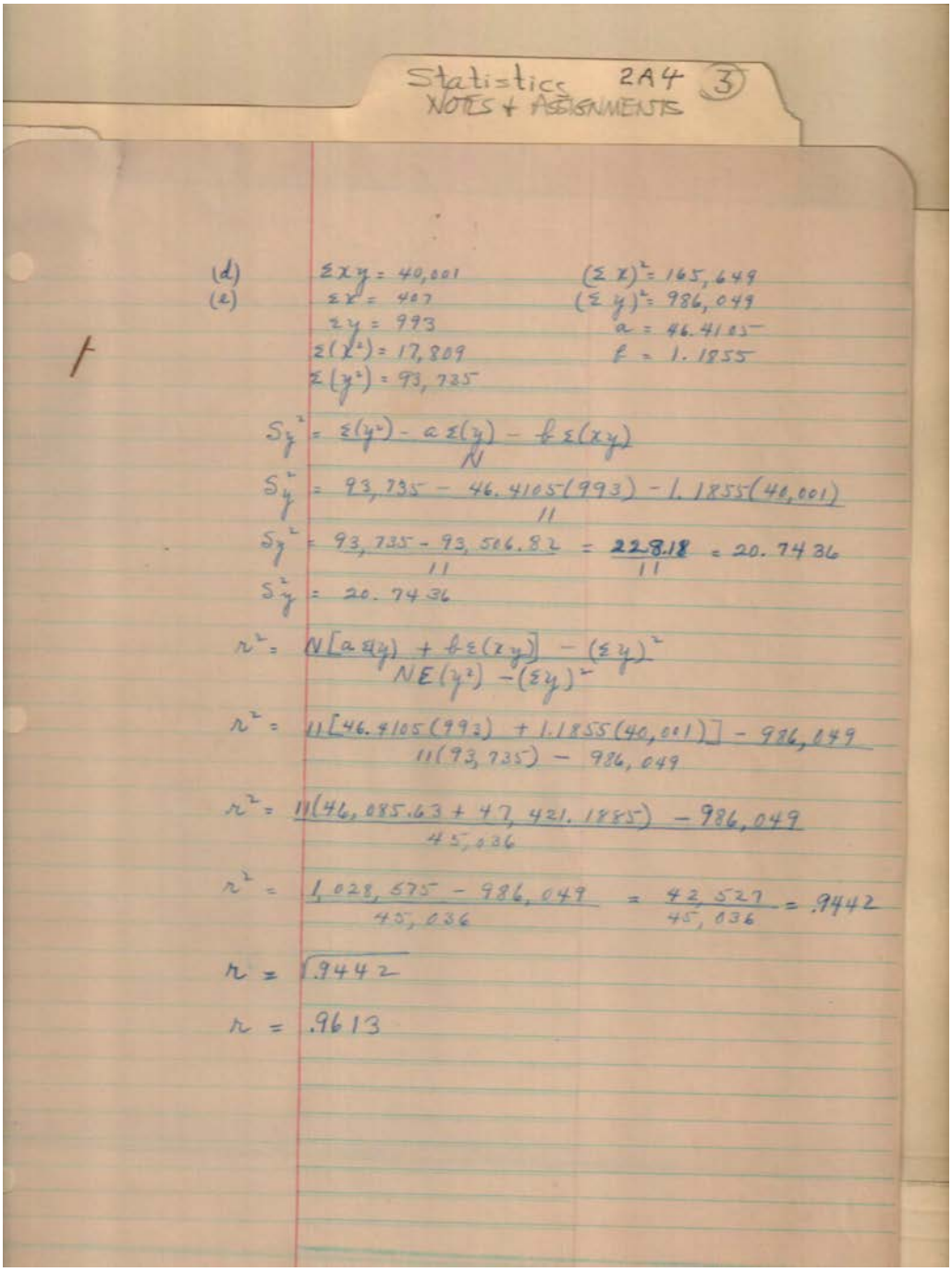
$y = 47.5955 = 47.6$

$x = 60$

$y = 46.4105 + 71.13 = 117.5405$

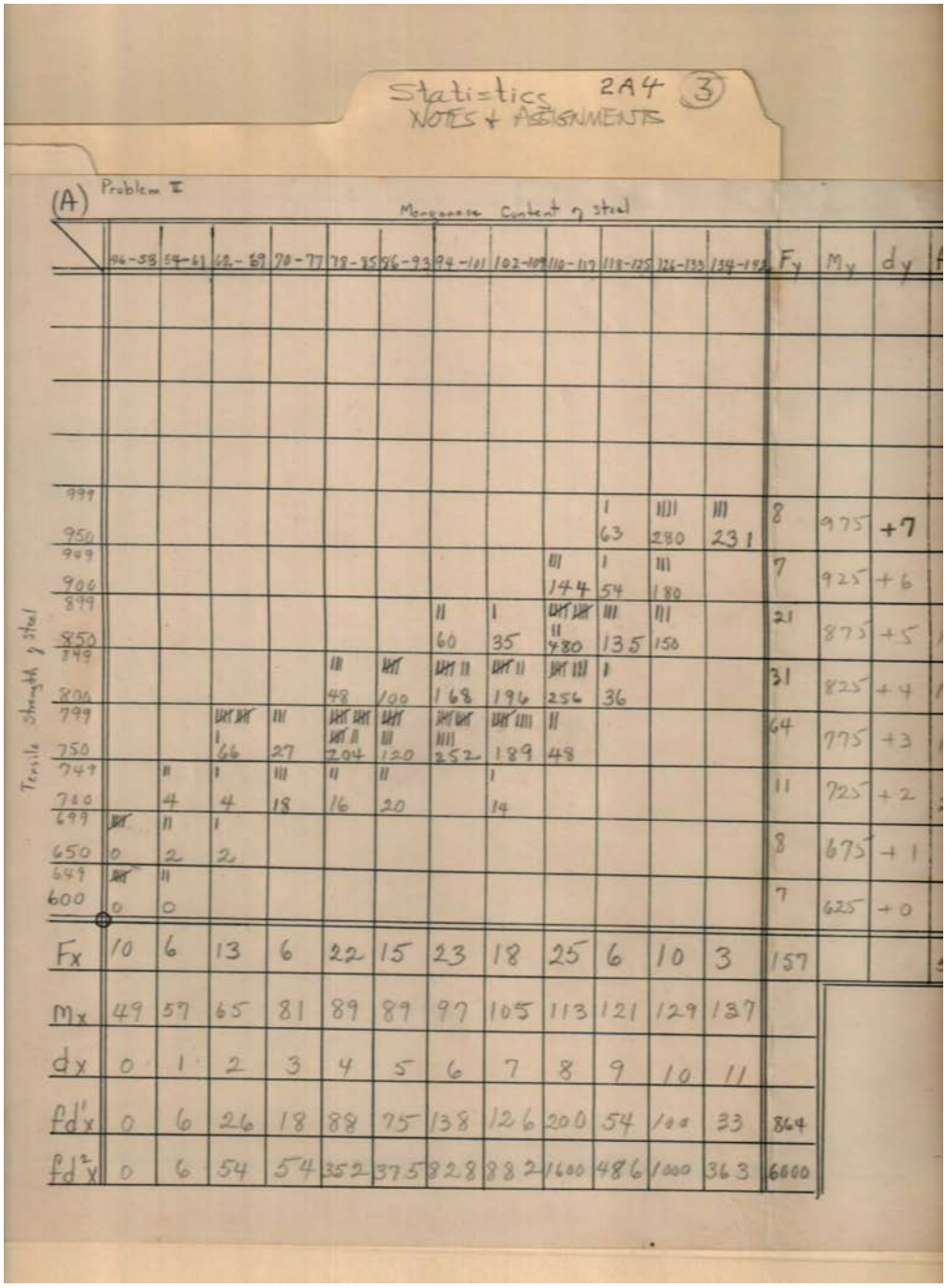
Names:
Statistical Notes

Types:
notes



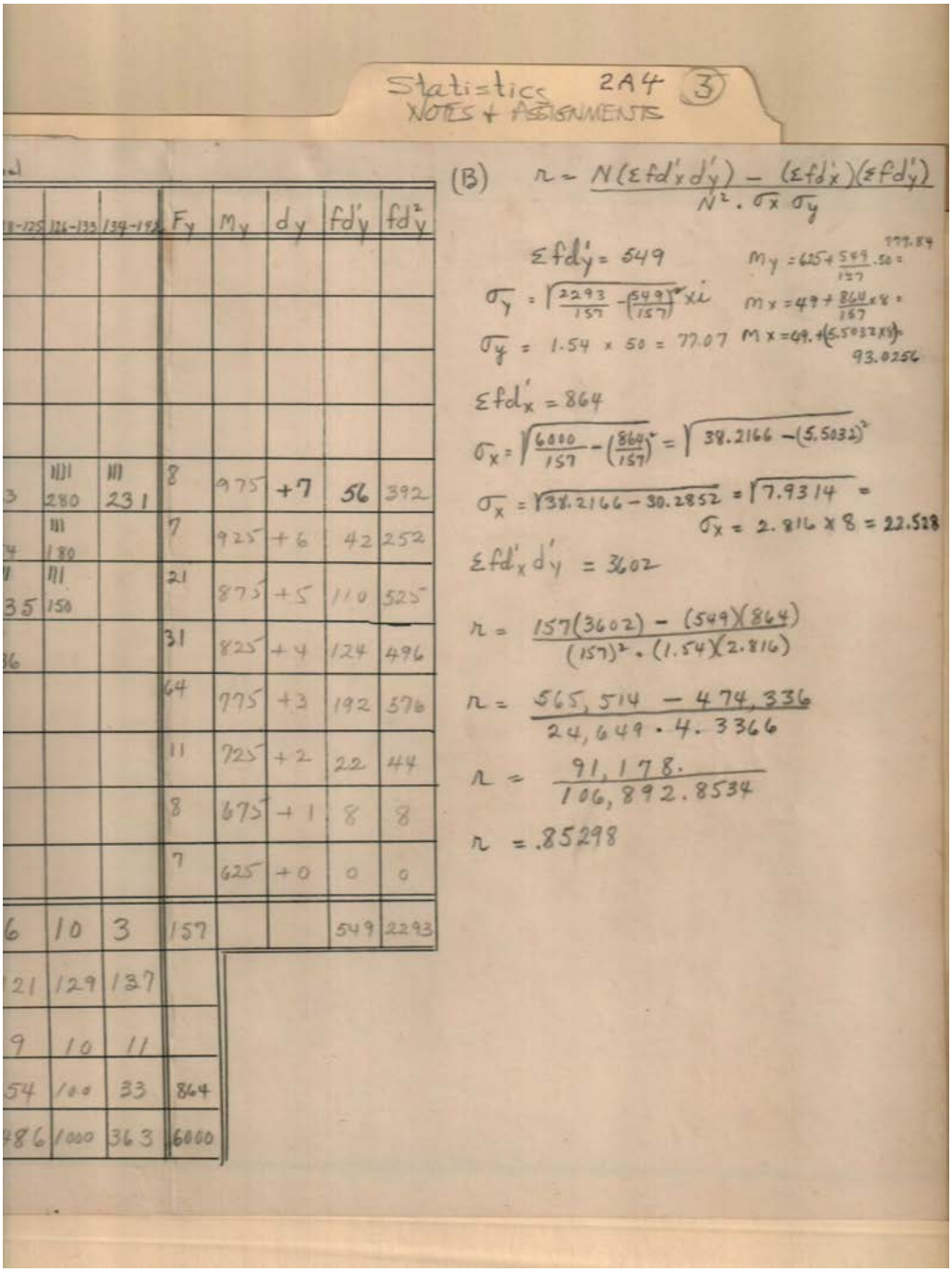
Names:
Statistical Notes

Types:
notes



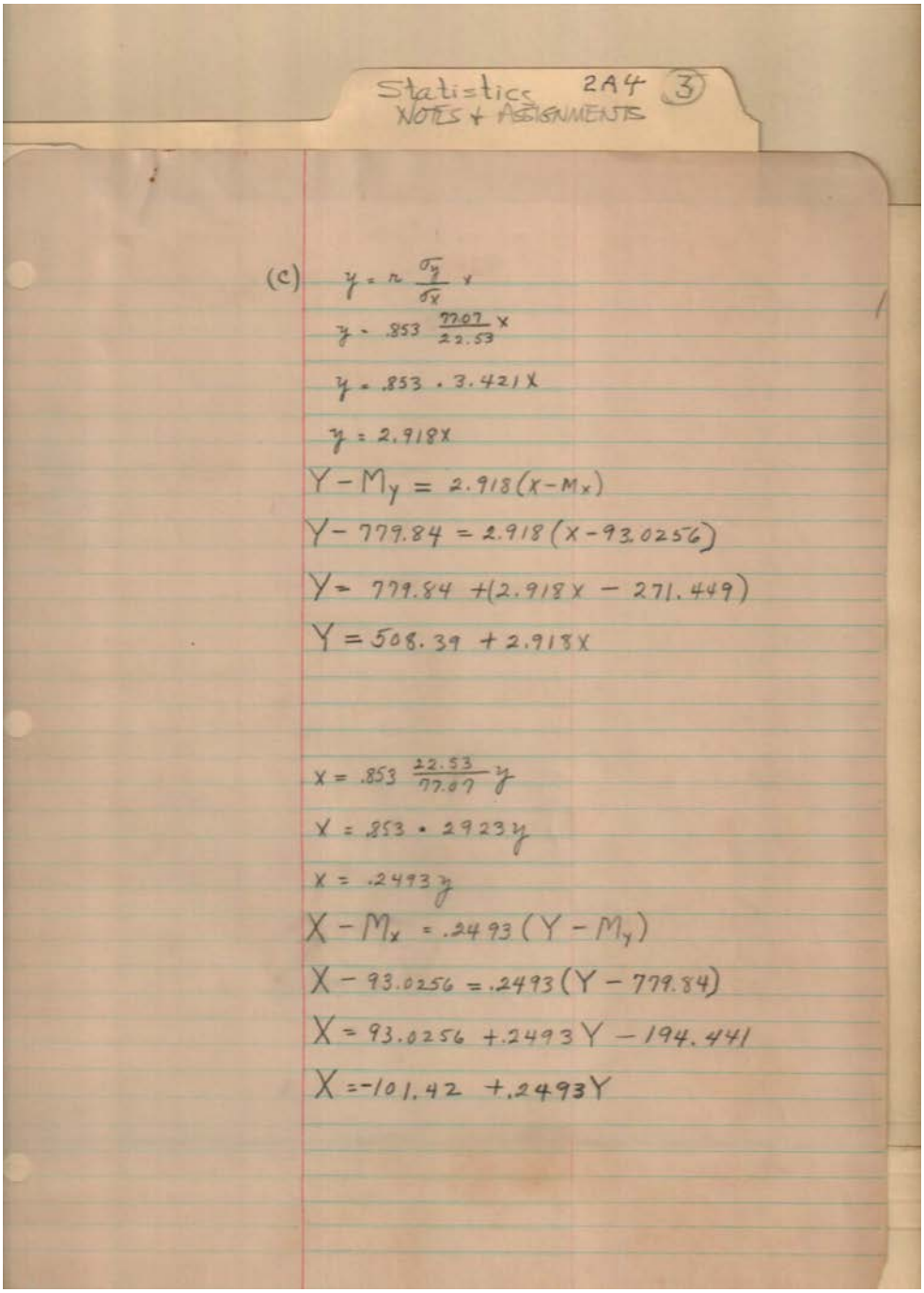
Names:
Statistical Notes

Types:
notes



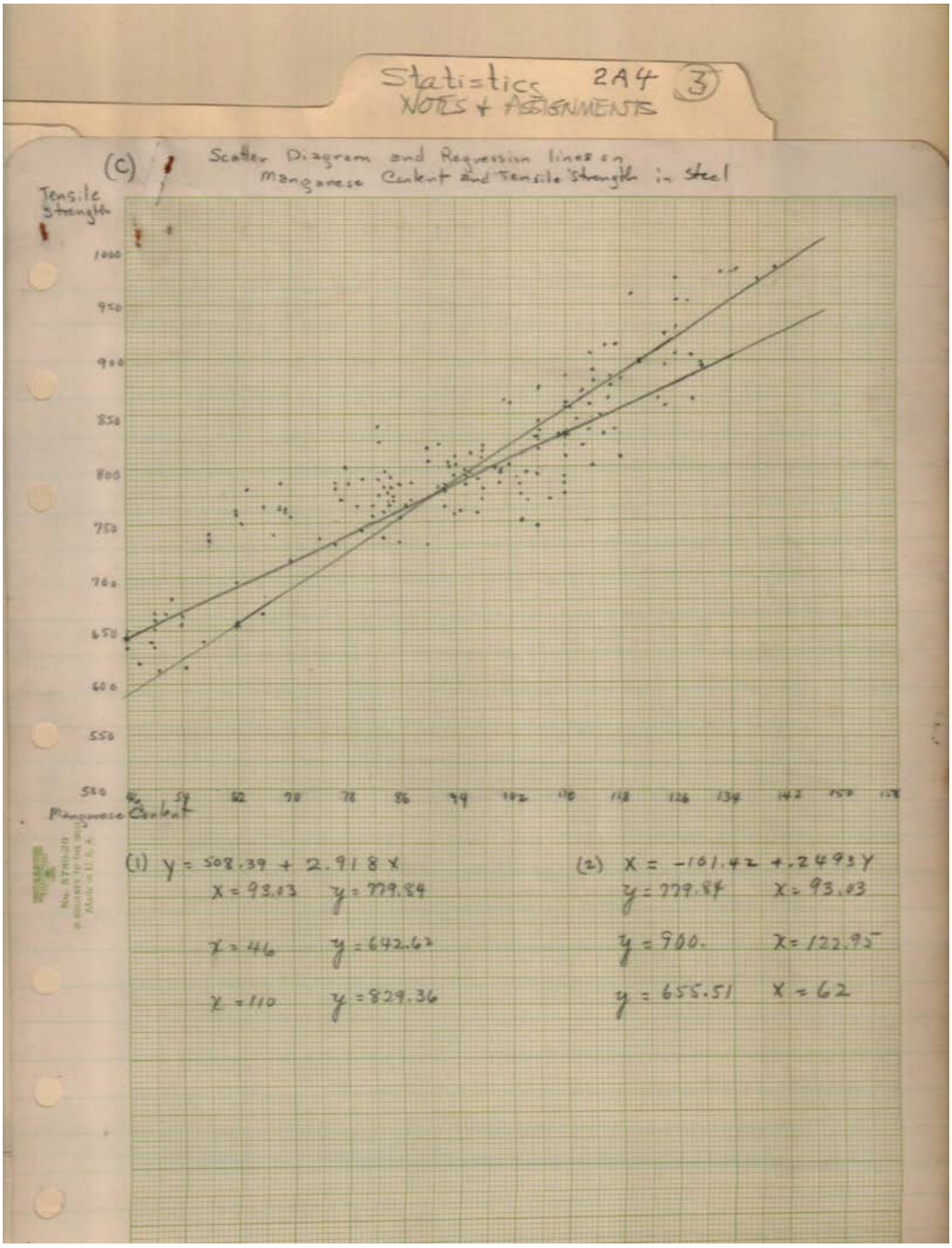
Names:
Statistical Notes

Types:
notes



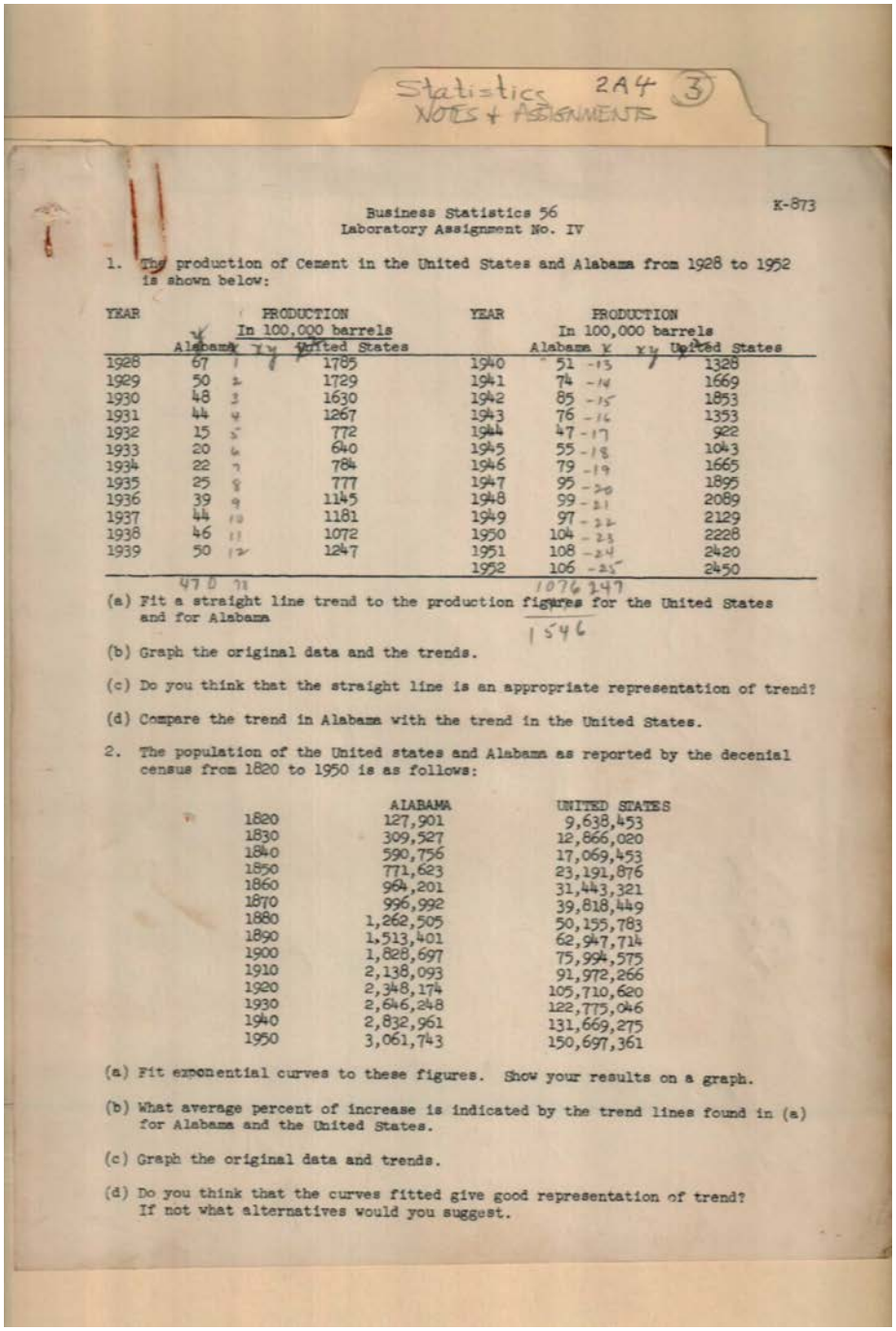
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-873

Business Statistics 56
Laboratory Assignment No. IV

1. The production of Cement in the United States and Alabama from 1928 to 1952 is shown below:

YEAR	PRODUCTION In 100,000 barrels Alabama		YEAR	PRODUCTION In 100,000 barrels Alabama	United States
1928	67	1785	1940	51	1328
1929	50	1729	1941	74	1669
1930	48	1630	1942	85	1853
1931	44	1267	1943	76	1353
1932	15	772	1944	47	922
1933	20	640	1945	55	1043
1934	22	784	1946	79	1665
1935	25	777	1947	95	1895
1936	39	1145	1948	99	2089
1937	44	1181	1949	97	2129
1938	46	1072	1950	104	2228
1939	50	1247	1951	108	2420
			1952	106	2450

(a) Fit a straight line trend to the production figures for the United States and for Alabama

(b) Graph the original data and the trends.

(c) Do you think that the straight line is an appropriate representation of trend?

(d) Compare the trend in Alabama with the trend in the United States.

2. The population of the United states and Alabama as reported by the decenial census from 1820 to 1950 is as follows:

	ALABAMA	UNITED STATES
1820	127,901	9,638,453
1830	309,527	12,866,020
1840	590,756	17,069,453
1850	771,623	23,191,876
1860	964,201	31,443,321
1870	996,992	39,818,449
1880	1,262,505	50,155,783
1890	1,513,401	62,947,714
1900	1,828,697	75,994,575
1910	2,138,093	91,972,266
1920	2,348,174	105,710,620
1930	2,646,248	122,775,046
1940	2,832,961	131,669,275
1950	3,061,743	150,697,361

(a) Fit exponential curves to these figures. Show your results on a graph.

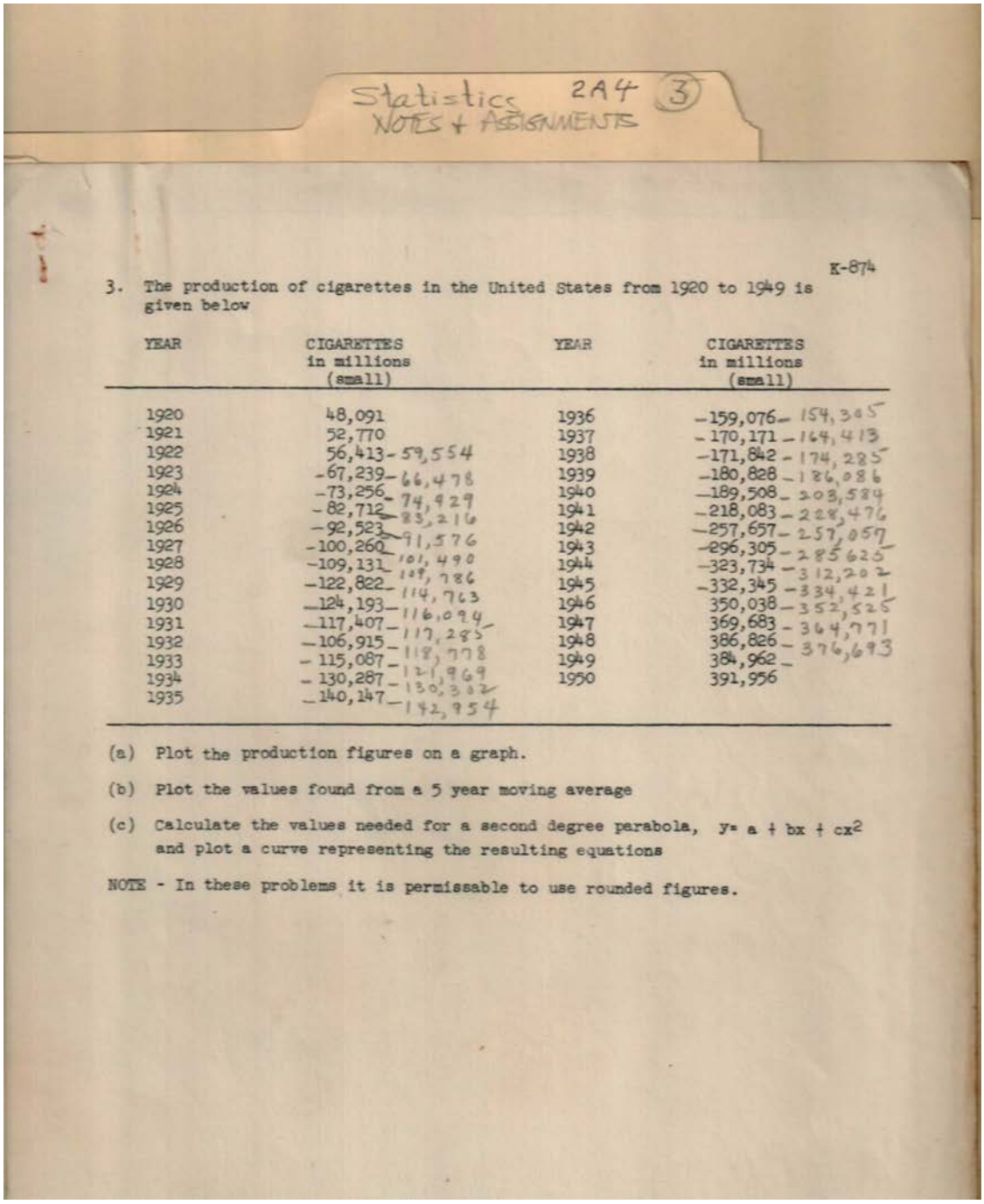
(b) What average percent of increase is indicated by the trend lines found in (a) for Alabama and the United States.

(c) Graph the original data and trends.

(d) Do you think that the curves fitted give good representation of trend? If not what alternatives would you suggest.

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-874

3. The production of cigarettes in the United States from 1920 to 1949 is given below

YEAR	CIGARETTES in millions (small)	YEAR	CIGARETTES in millions (small)
1920	48,091	1936	159,076 – 154,305
1921	52,770	1937	170,171 – 164,413
1922	56,413 – 59,554	1938	171,842 – 174,285
1923	67,239 – 66,478	1939	180,828 – 186,086
1924	73,256 – 74,929	1940	189,508 – 203,584
1925	82,712 – 85,216	1941	218,083 – 228,476
1926	92,523 – 91,576	1942	257,657 – 257,057
1927	100,260 – 101,490	1943	296,305 – 285625
1928	109,131 – 109,786	1944	323,734 – 312,202
1929	122,822 – 114,763	1945	332,345 – 334,421
1930	124,193 – 116,094	1946	350,038 – 352,525
1931	117,407 – 117,285	1947	369,683 – 364,771
1932	106,915 – 118,778	1948	386,826 – 376,693
1933	115,087 – 121,969	1949	384,962 –
1934	130,287 – 130,302	1950	391,956
1935	140,147 – 142,954		

(a) Plot the production figures on a graph.

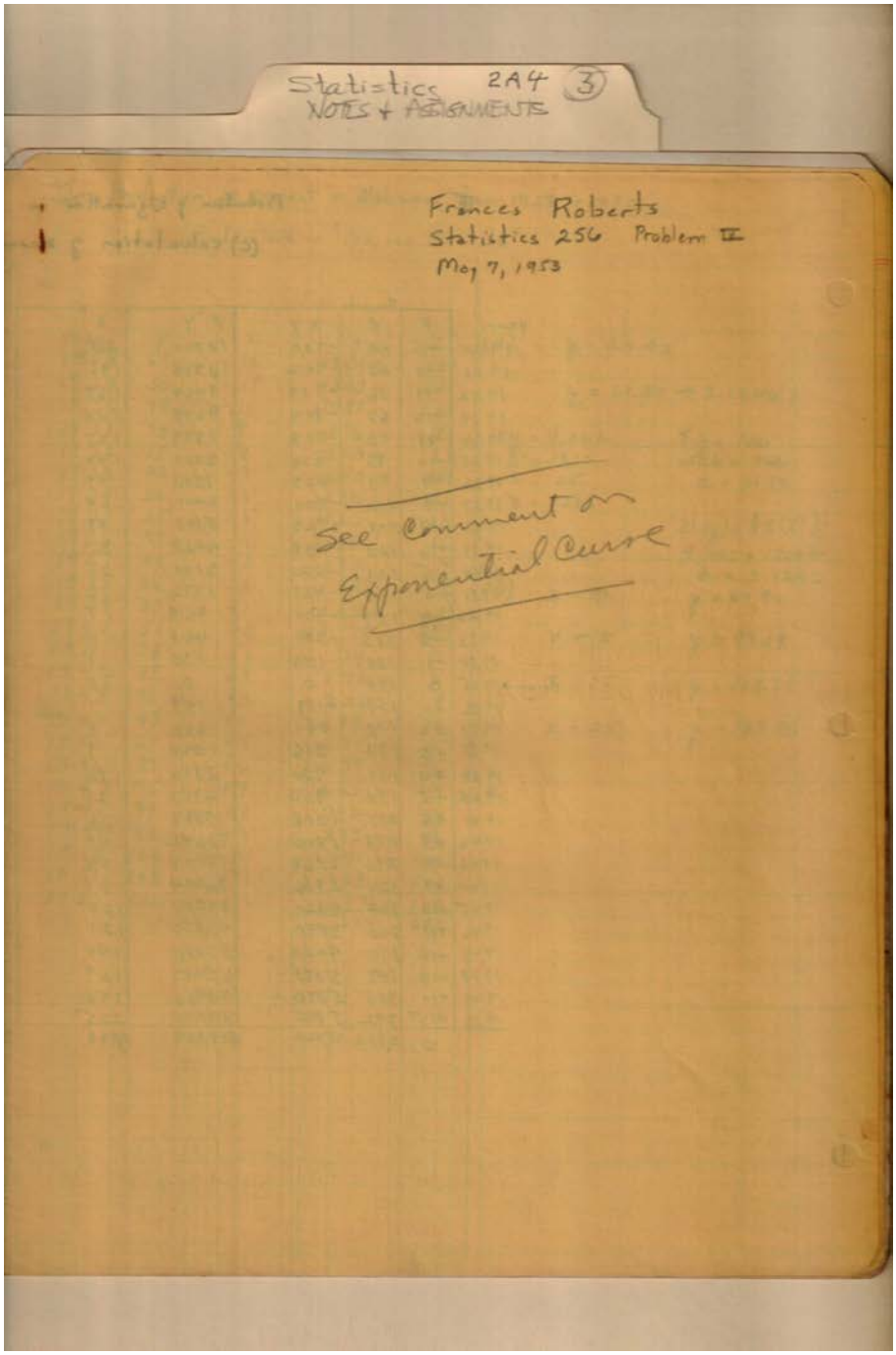
(b) Plot the values found from a 5 year moving average

(c) Calculate the values needed for a second degree parabola, $y = a + bx + cx^2$ and plot a curve representing the resulting equations

NOTE - In these problems it is permissable to use rounded figures.

Names:
Statistical Notes

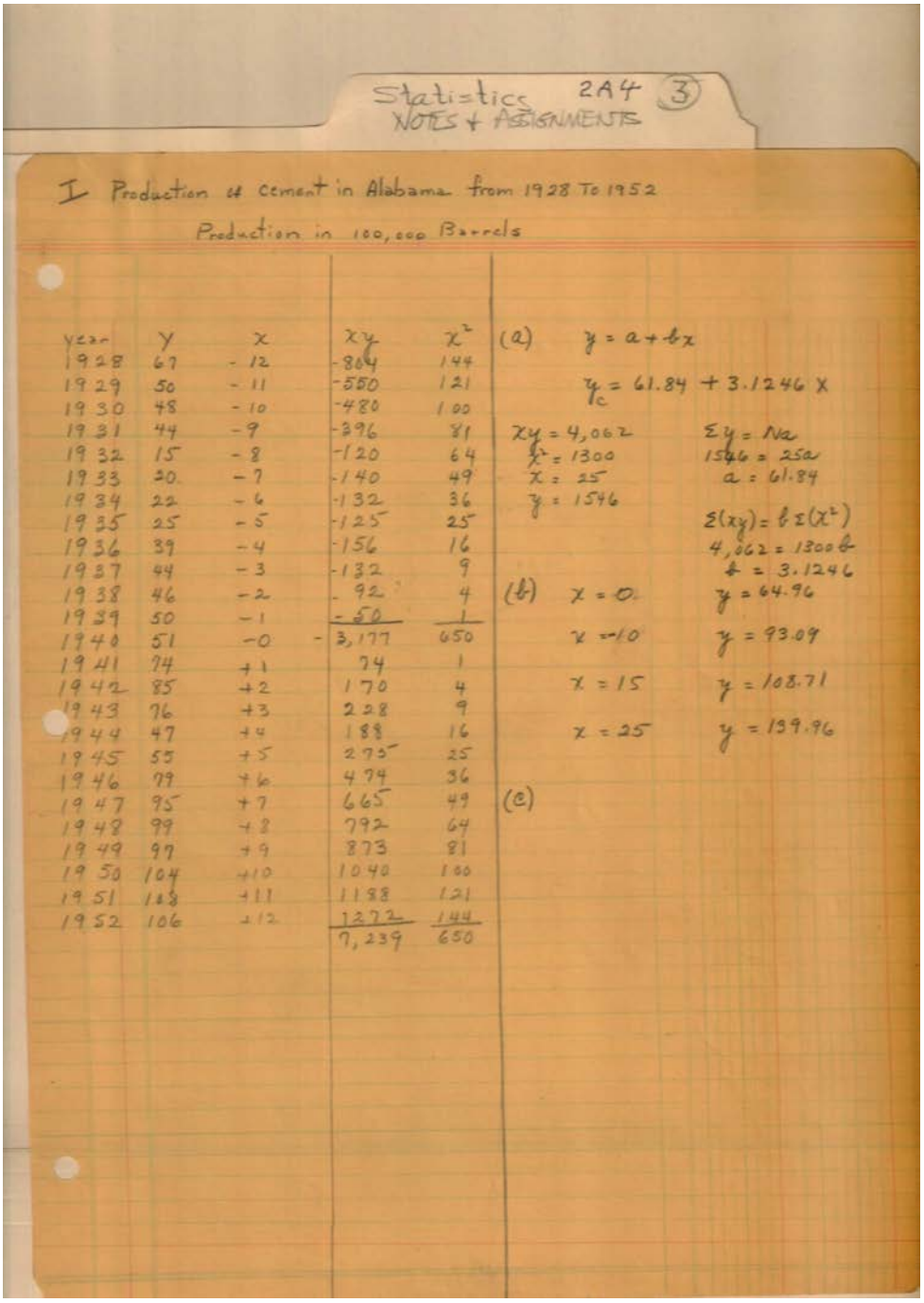
Types:
notes



Names:
Roberts, Frances

Types:
notes

Dates:
May 07, 1953



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

I Production of cement in Alabama from 1928 To 1952

Production in 100,000 Barrels

year	y	x	xy	x^2
1928	67	-12	-804	144
1929	50	-11	-550	121
1930	48	-10	-480	100
1931	44	-9	-396	81
1932	15	-8	-120	64
1933	20	-7	-140	49
1934	22	-6	-132	36
1935	25	-5	-125	25
1936	39	-4	-156	16
1937	44	-3	-132	9
1938	46	-2	-92	4
1939	50	-1	-50	1
1940	51	-0	-3,177	650
1941	74	+1	74	1
1942	85	+2	170	4
1943	76	+3	228	9
1944	47	+4	188	16
1945	55	+5	275	25
1946	79	+6	474	36
1947	95	+7	665	49
1948	99	+8	792	64
1949	97	+9	873	81
1950	104	+10	1040	100
1951	109	+11	1198	121
1952	106	+12	1272	144
			7,239	650

(a) $y = a + bx$

$y_c = 61.84 + 3.1246\,x$

$\Sigma xy = 4,062$ $\quad \Sigma y = Na$
$\Sigma x^2 = 1300$ $\quad 1546 = 25a$
$x = 25$ $\quad a = 61.84$
$y = 1546$

$\Sigma(xy) = b\Sigma(x^2)$
$4,062 = 1300\,b$
$b = 3.1246$

(b) $x = 0$ $\quad y = 64.96$

$x = 10$ $\quad y = 93.09$

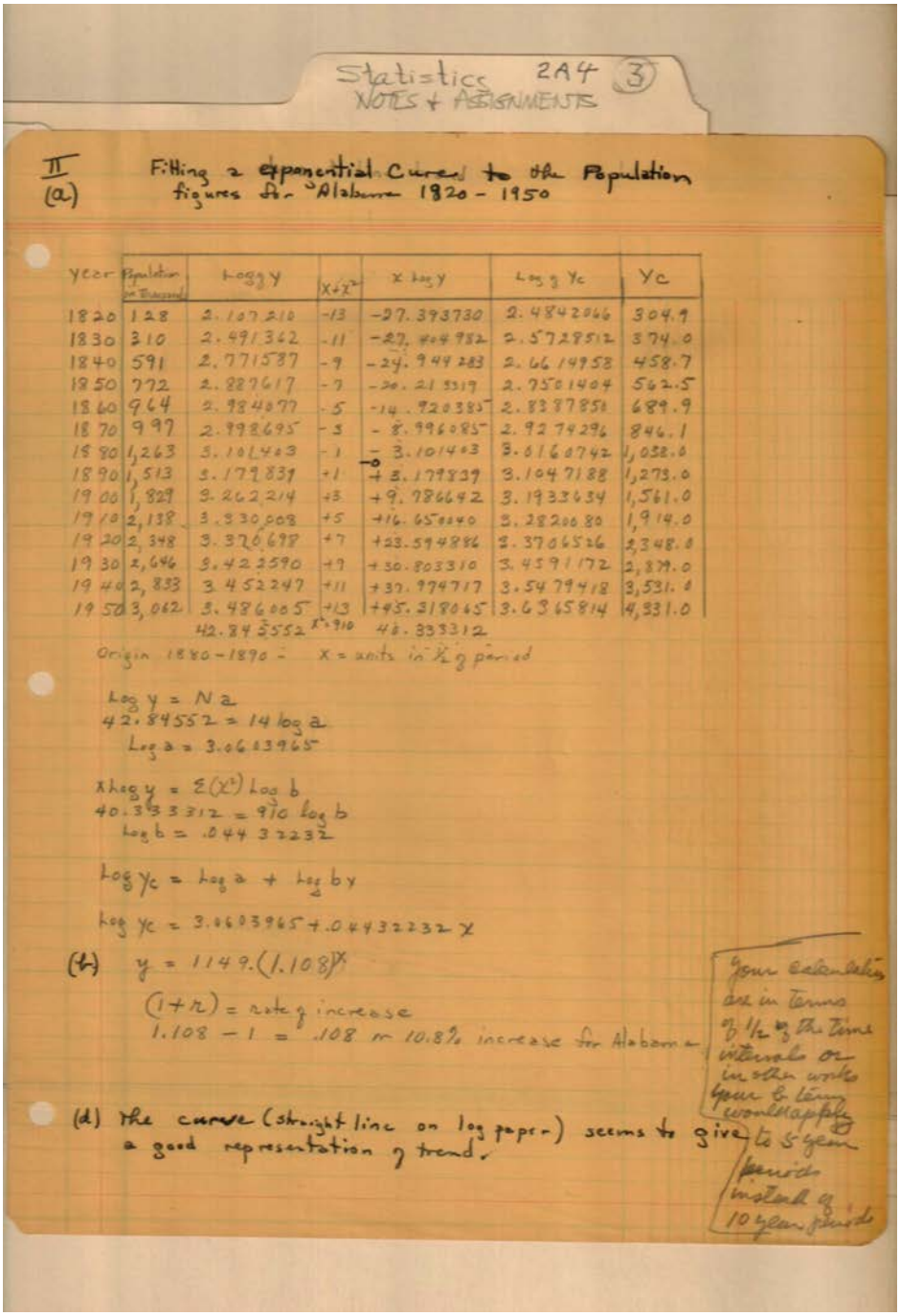
$x = 15$ $\quad y = 108.71$

$x = 25$ $\quad y = 139.96$

(c)

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

II (a) Fitting a exponential Curve to the Population figures for Alabama 1820 - 1950

year	Population in Thousands	Log y	x	x log y	Log y Yc	Yc
1820	128	2.107210	-13	-27.393730	2.4842046	304.9
1830	310	2.491362	-11	-27.404982	2.5728512	374.0
1840	591	2.771587	-9	-24.944283	2.6614958	458.7
1850	772	2.887617	-7	-20.213319	2.7501404	562.5
1860	964	2.984077	-5	-14.920385	2.8387851	689.9
1870	997	2.998695	-3	- 8.996085	2.9274296	846.1
1880	1,263	3.101403	-1	- 3.101403	3.0160742	1,038.6
1890	1,513	3.179839	+1	+ 3.179839	3.1047188	1,273.0
1900	1,829	3.262214	+3	+9.786642	3.1933634	1,561.0
1910	2,138	3.330308	+5	+16.651540	3.2820080	1,914.0
1920	2,348	3.370698	+7	+23.594886	3.3706526	2,348.8
1930	2,646	3.423590	+9	+30.803310	3.4591172	2,879.0
1940	2,833	3.452247	+11	+37.974717	3.5479418	3,531.6
1950	3,062	3.486005	+13	+45.318065	3.6365814	4,331.0
		42.845552	Σx^2 910	48.333312		

Origin 1880-1890 - x = units in 10 yr period

Log y = N a
42.84552 = 14 log a
Log a = 3.0603965

x log y = $\Sigma(x^2)$ log b
40.333312 = 910 log b
log b = .044 32232

Log yc = log a + log b x

log yc = 3.0603965 + .044 32232 x

(b) $y = 1149.(1.108)^x$

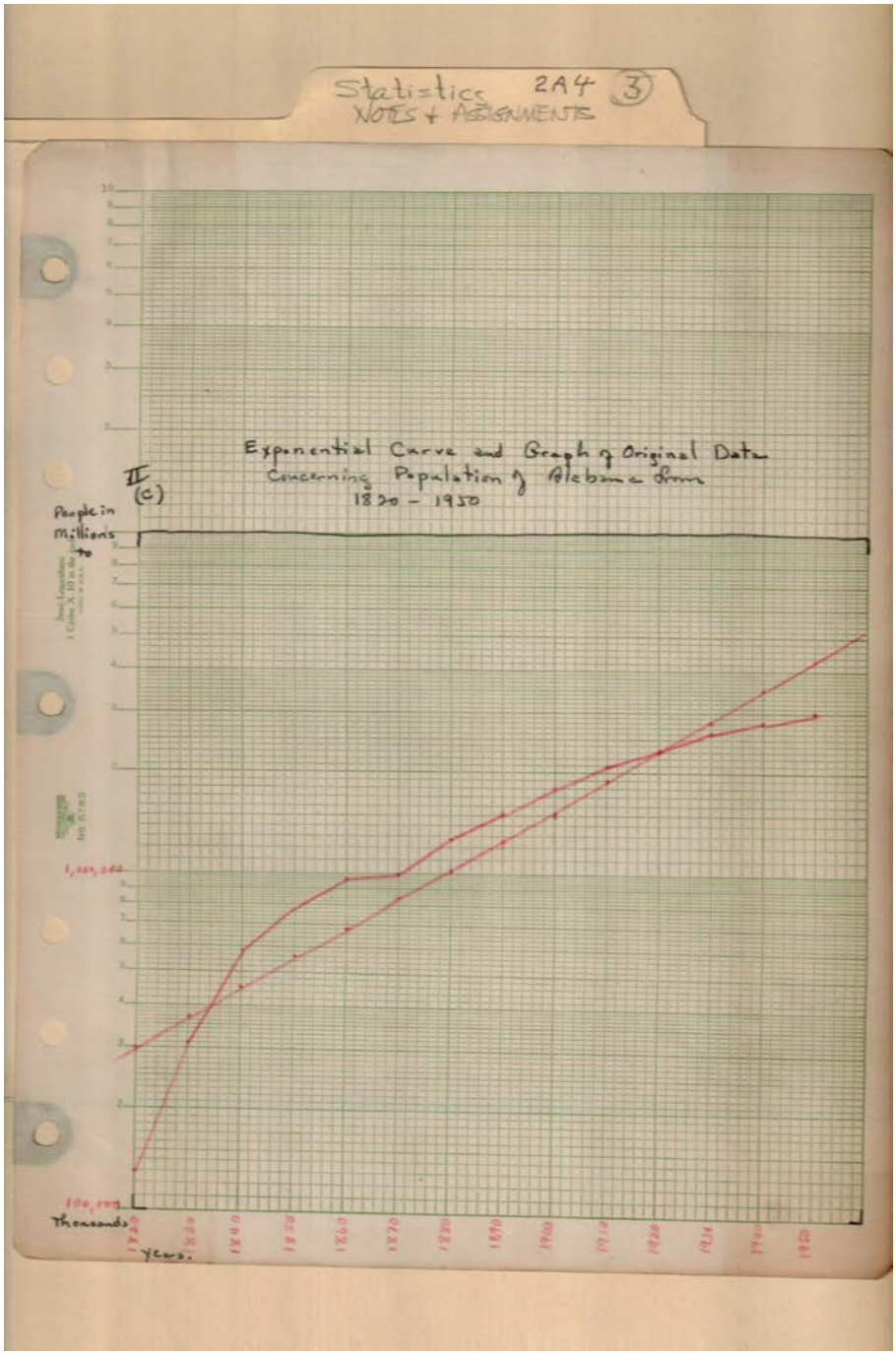
(1+r) = rate of increase
1.108 - 1 = .108 = 10.8% increase for Alabama

(d) The curve (straight line on log paper) seems to give a good representation of trend.

Your calculations are in terms of 1/2 of the time intervals or in other words your b term would apply to 5 year periods instead of 10 year periods

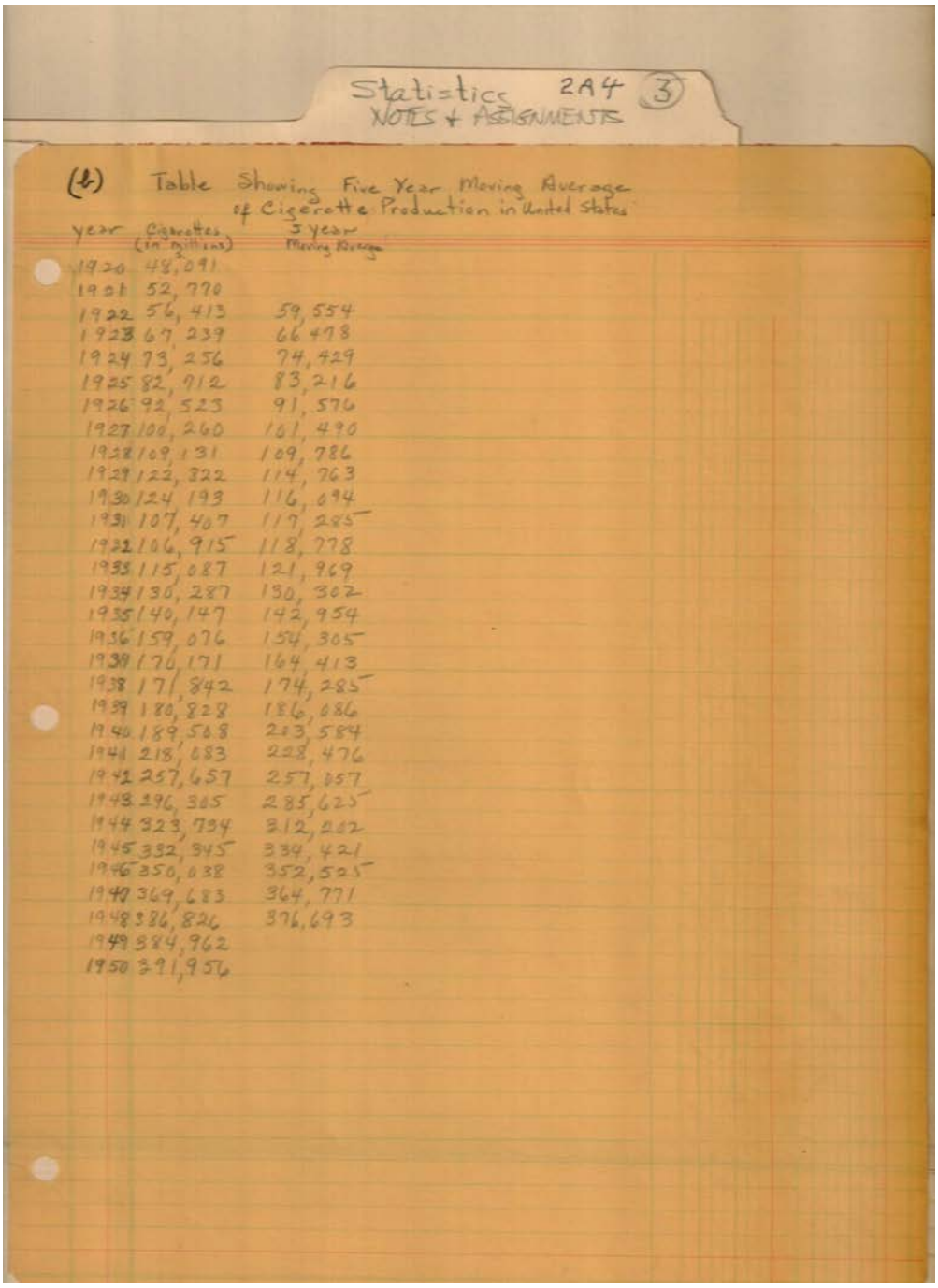
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



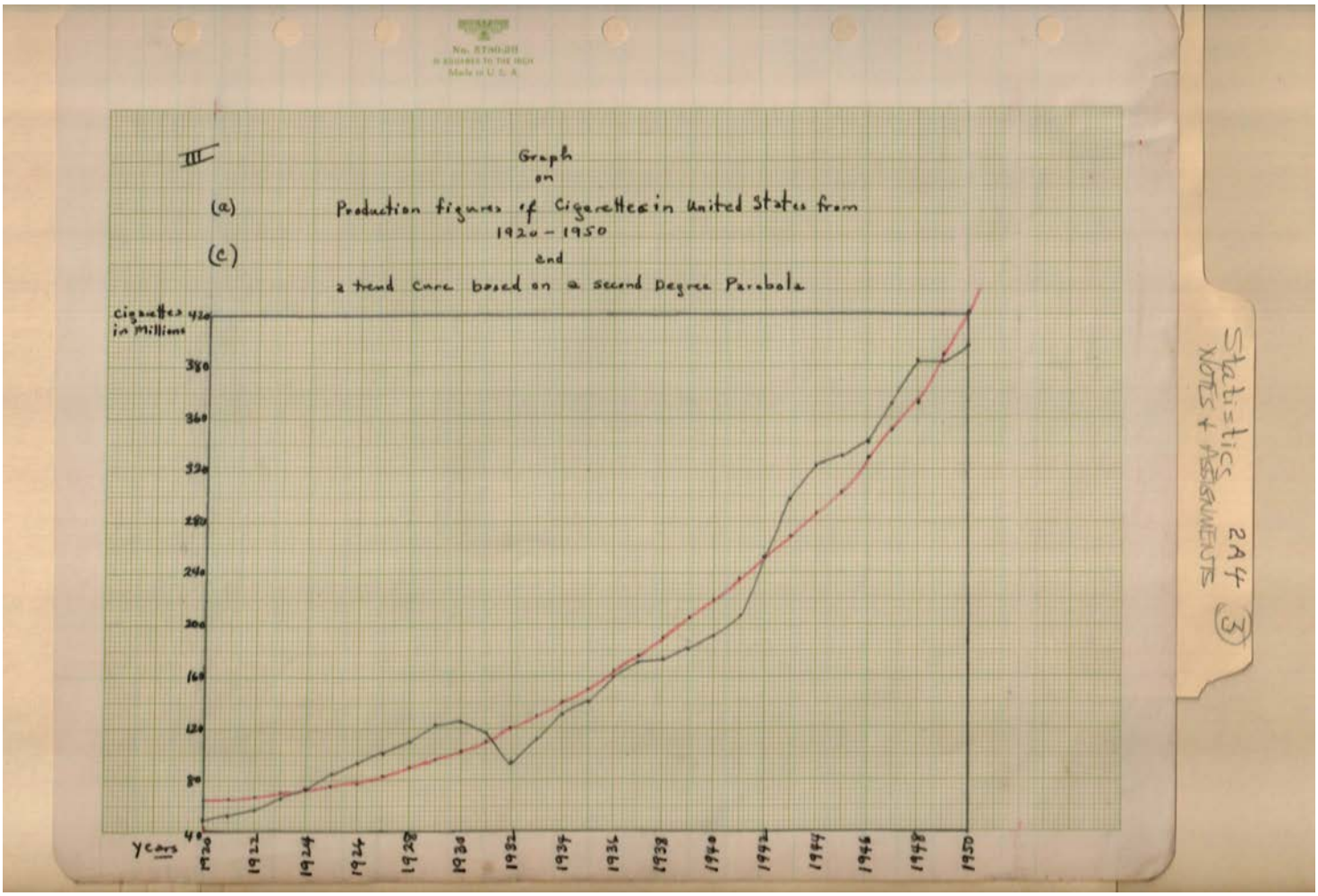
Statistics 2A4 (3)
NOTES + ASSIGNMENTS

(4) Table Showing Five Year Moving Average of Cigarette Production in United States

year	Cigarettes (in millions)	5 year Moving Average
1920	48,091	
1921	52,770	
1922	56,413	59,554
1923	67,239	66,478
1924	73,256	74,429
1925	82,912	83,216
1926	92,523	91,576
1927	100,260	101,490
1928	109,131	109,786
1929	122,822	114,763
1930	124,193	116,694
1931	107,407	117,285
1932	106,915	118,778
1933	115,087	121,969
1934	130,287	130,302
1935	140,147	142,954
1936	159,076	154,305
1937	176,171	164,413
1938	171,842	174,285
1939	180,828	186,086
1940	189,568	203,584
1941	218,683	228,476
1942	257,657	257,057
1943	296,305	285,625
1944	323,734	312,282
1945	332,345	334,421
1946	350,038	352,525
1947	369,683	364,771
1948	386,826	376,693
1949	384,962	
1950	391,956	

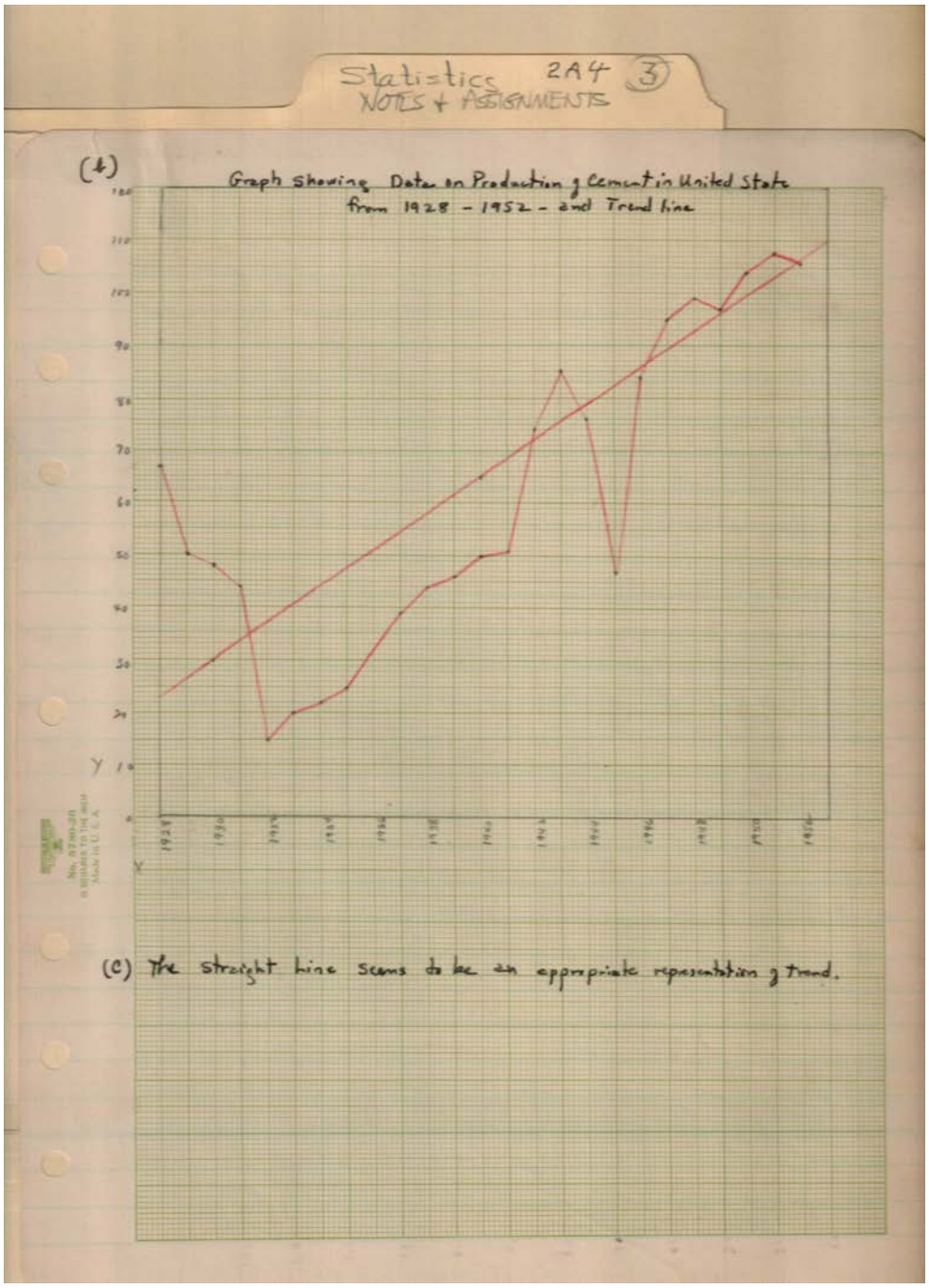
Names:
Statistical Notes

Types:
notes



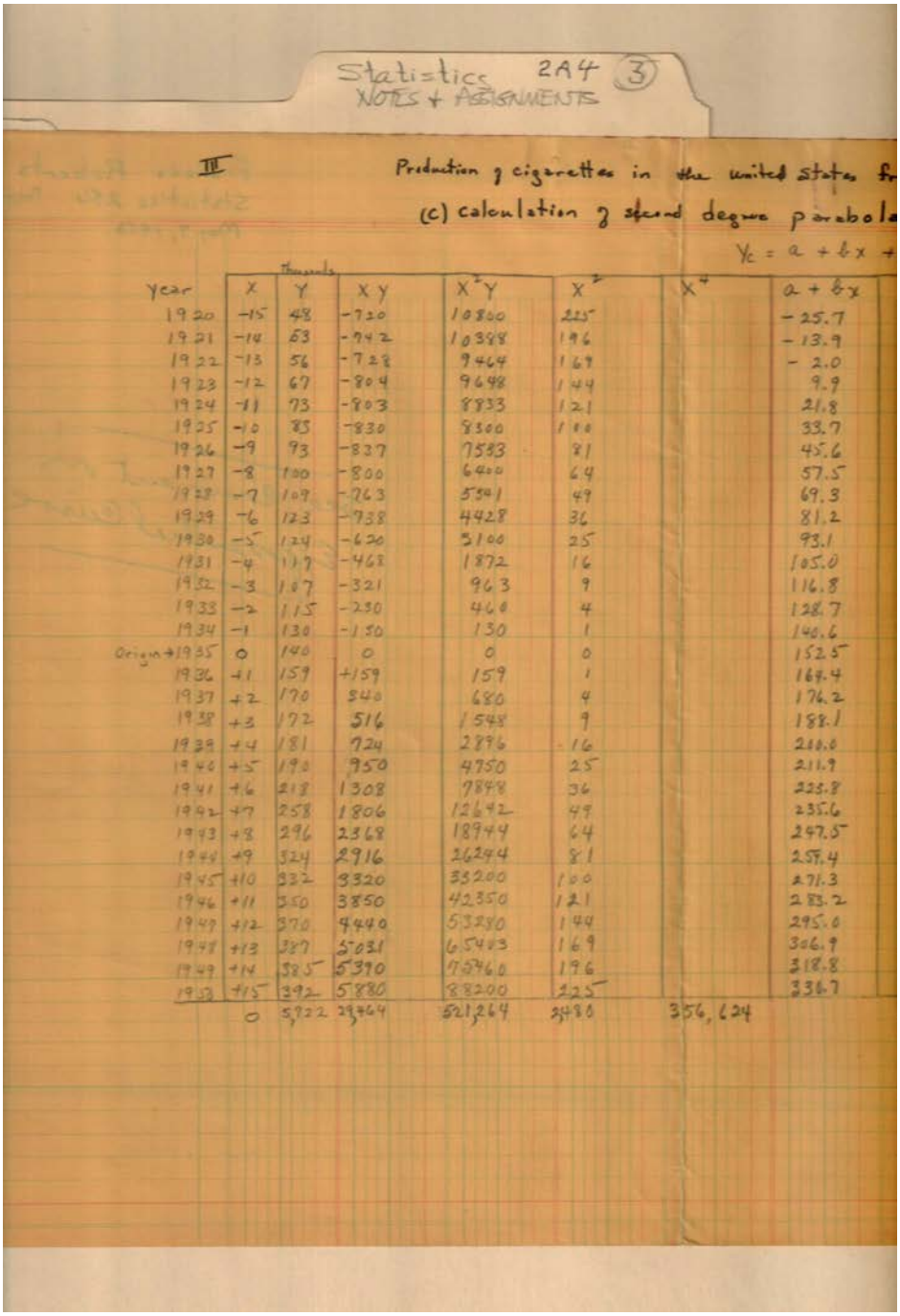
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

III Production of cigarettes in the united states fr

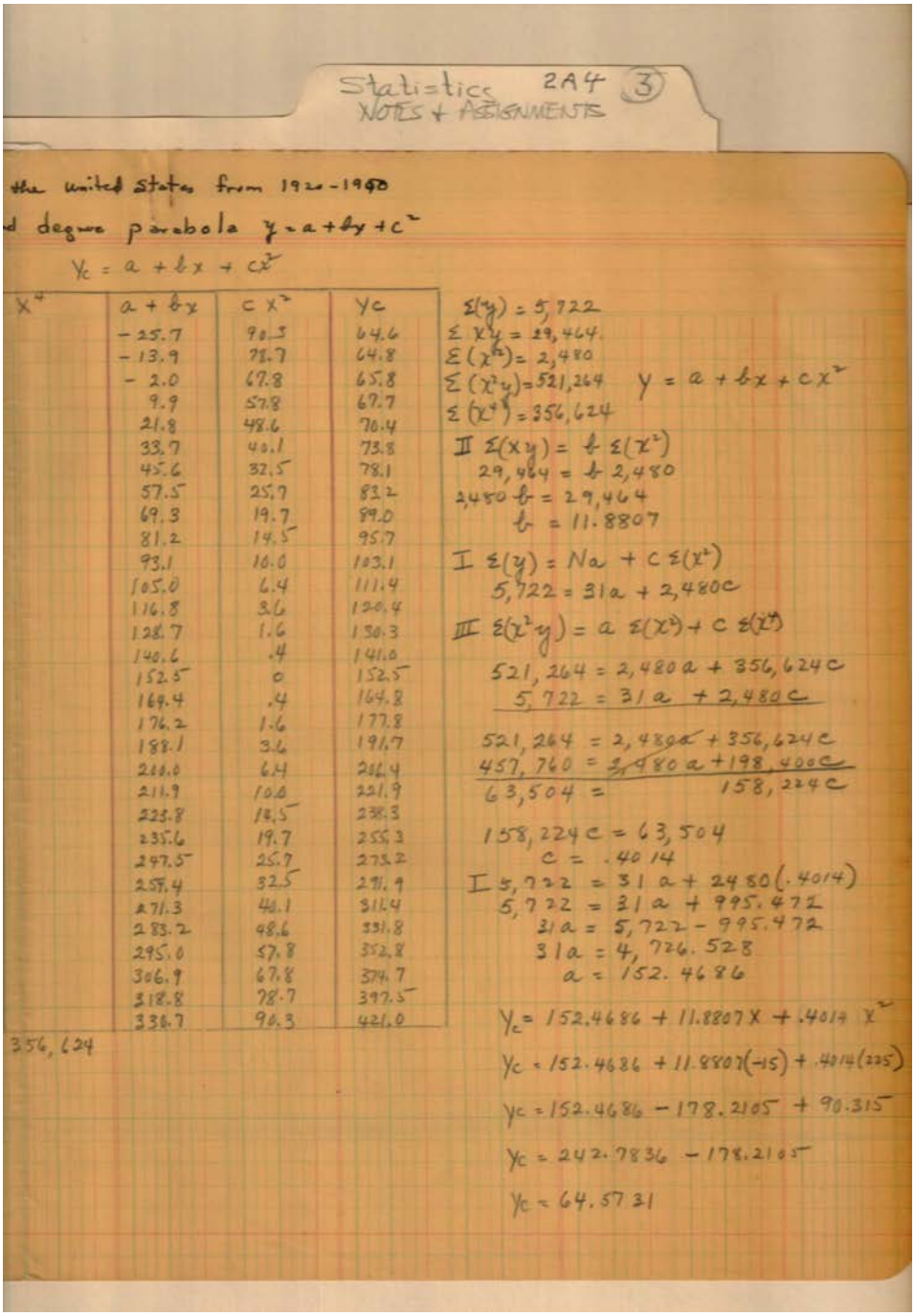
(c) calculation of second degree parabola

$Y_c = a + bx +$

Year	X	Y (thousands)	XY	X^2Y	X^2	X^4	$a + bx$
1920	-15	48	-720	10800	225		-25.7
1921	-14	63	-942	10388	196		-13.9
1922	-13	56	-728	9464	169		- 2.0
1923	-12	67	-804	9648	144		9.9
1924	-11	73	-803	8833	121		21.8
1925	-10	85	-830	8300	100		33.7
1926	-9	93	-837	7583	81		45.6
1927	-8	100	-800	6400	64		57.5
1928	-7	109	-763	5341	49		69.3
1929	-6	123	-738	4428	36		81.2
1930	-5	124	-620	3100	25		93.1
1931	-4	117	-468	1872	16		105.0
1932	-3	107	-321	963	9		116.8
1933	-2	115	-230	460	4		128.7
1934	-1	130	-130	130	1		140.6
Origin→1935	0	140	0	0	0		152.5
1936	+1	159	+159	159	1		164.4
1937	+2	170	340	680	4		176.2
1938	+3	172	516	1548	9		188.1
1939	+4	181	724	2896	16		200.0
1940	+5	190	950	4750	25		211.9
1941	+6	218	1308	7848	36		223.8
1942	+7	258	1806	12642	49		235.6
1943	+8	296	2368	18944	64		247.5
1944	+9	324	2916	26244	81		259.4
1945	+10	332	3320	33200	100		271.3
1946	+11	350	3850	42350	121		283.2
1947	+12	370	4440	53280	144		295.0
1948	+13	387	5031	65403	169		306.9
1949	+14	385	5390	75460	196		318.8
1950	+15	392	5880	88200	225		330.7
	0	5,922	29,764	521,264	2480	356,624	

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

the United States from 1920-1960

d degree parabola $y = a + bx + cx^2$

$Y_c = a + bx + cx^2$

x^4	$a + bx$	$c x^2$	Yc
	-25.7	90.3	64.6
	-13.9	78.7	64.8
	- 2.0	67.8	65.8
	9.9	57.8	67.7
	21.8	48.6	70.4
	33.7	40.1	73.8
	45.6	32.5	78.1
	57.5	25.7	83.2
	69.3	19.7	89.0
	81.2	14.5	95.7
	93.1	10.0	103.1
	105.0	6.4	111.4
	116.8	3.6	120.4
	128.7	1.6	130.3
	140.6	.4	141.0
	152.5	0	152.5
	164.4	.4	164.8
	176.2	1.6	177.8
	188.1	3.6	191.7
	200.0	6.4	206.4
	211.9	10.0	221.9
	223.8	14.5	238.3
	235.6	19.7	255.3
	247.5	25.7	273.2
	259.4	32.5	291.9
	271.3	40.1	311.4
	283.2	48.6	331.8
	295.0	57.8	352.8
	306.9	67.8	374.7
	318.8	78.7	397.5
	330.7	90.3	421.0
356,624			

$\Sigma(y) = 5,722$
$\Sigma xy = 29,464$
$\Sigma(x^2) = 2,480$
$\Sigma(x^2y) = 521,264$ $y = a + bx + cx^2$
$\Sigma(x^4) = 356,624$

II $\Sigma(xy) = b\,\Sigma(x^2)$
$29,464 = b\ 2,480$
$2,480\,b = 29,464$
$b = 11.8807$

I $\Sigma(y) = Na + c\,\Sigma(x^2)$
$5,722 = 31a + 2,480c$

III $\Sigma(x^2y) = a\,\Sigma(x^3) + c\,\Sigma(x^4)$
$521,264 = 2,480a + 356,624c$
$5,722 = 31a + 2,480c$

$521,264 = 2,480a + 356,624c$
$457,760 = 2,480a + 198,400c$
$63,504 = 158,224c$

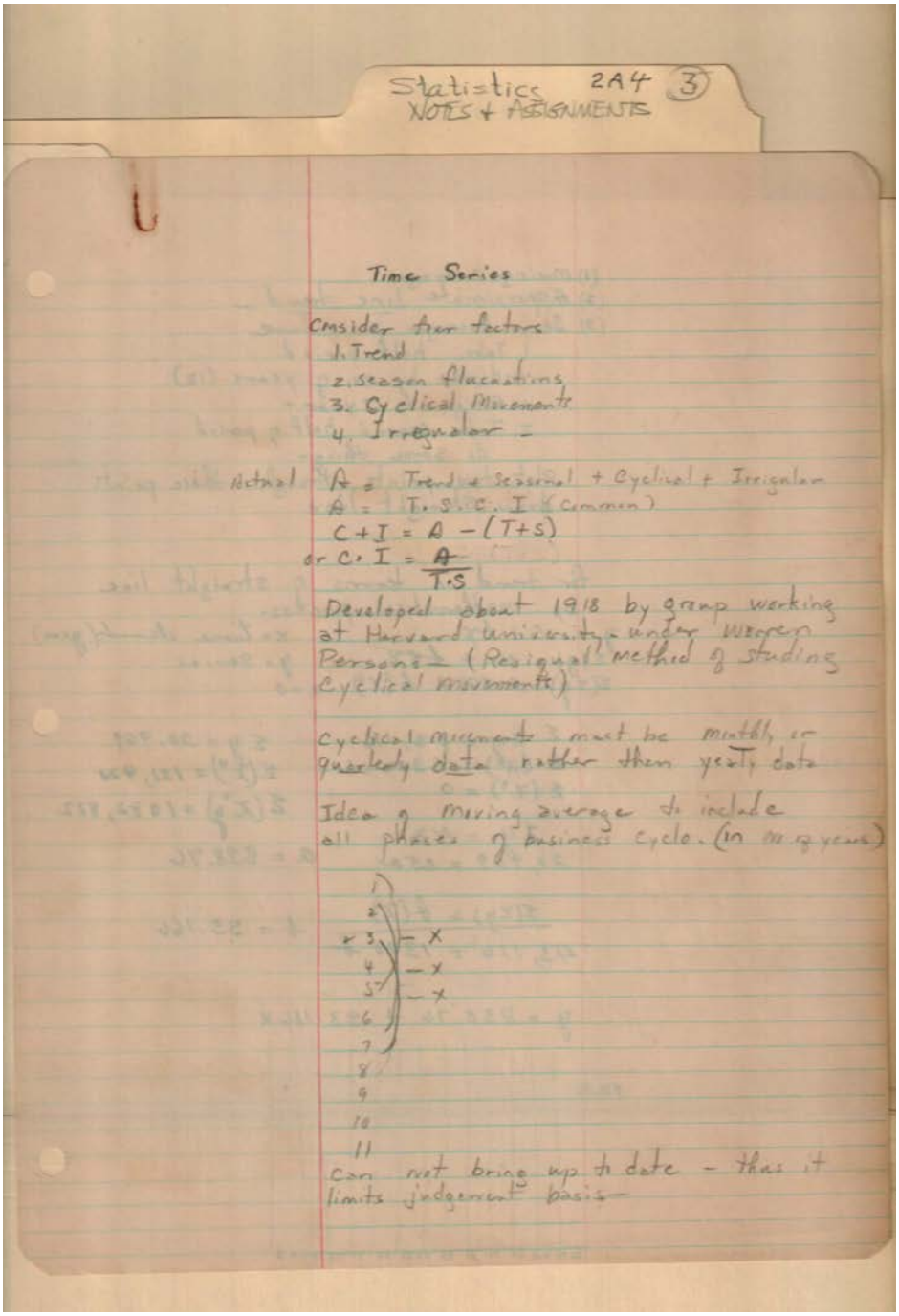
$158,224c = 63,504$
$c = .4014$

I $5,722 = 31a + 2480(.4014)$
$5,722 = 31a + 995.472$
$31a = 5,722 - 995.472$
$31a = 4,726.528$
$a = 152.4686$

$Y_c = 152.4686 + 11.8807X + .4014X^2$
$Yc = 152.4686 + 11.8807(-15) + .4014(225)$
$Yc = 152.4686 - 178.2105 + 90.315$
$Yc = 242.7836 - 178.2105$
$Yc = 64.5731$

Names:
Statistical Notes

Types:
notes



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Statistical Notes

Types:
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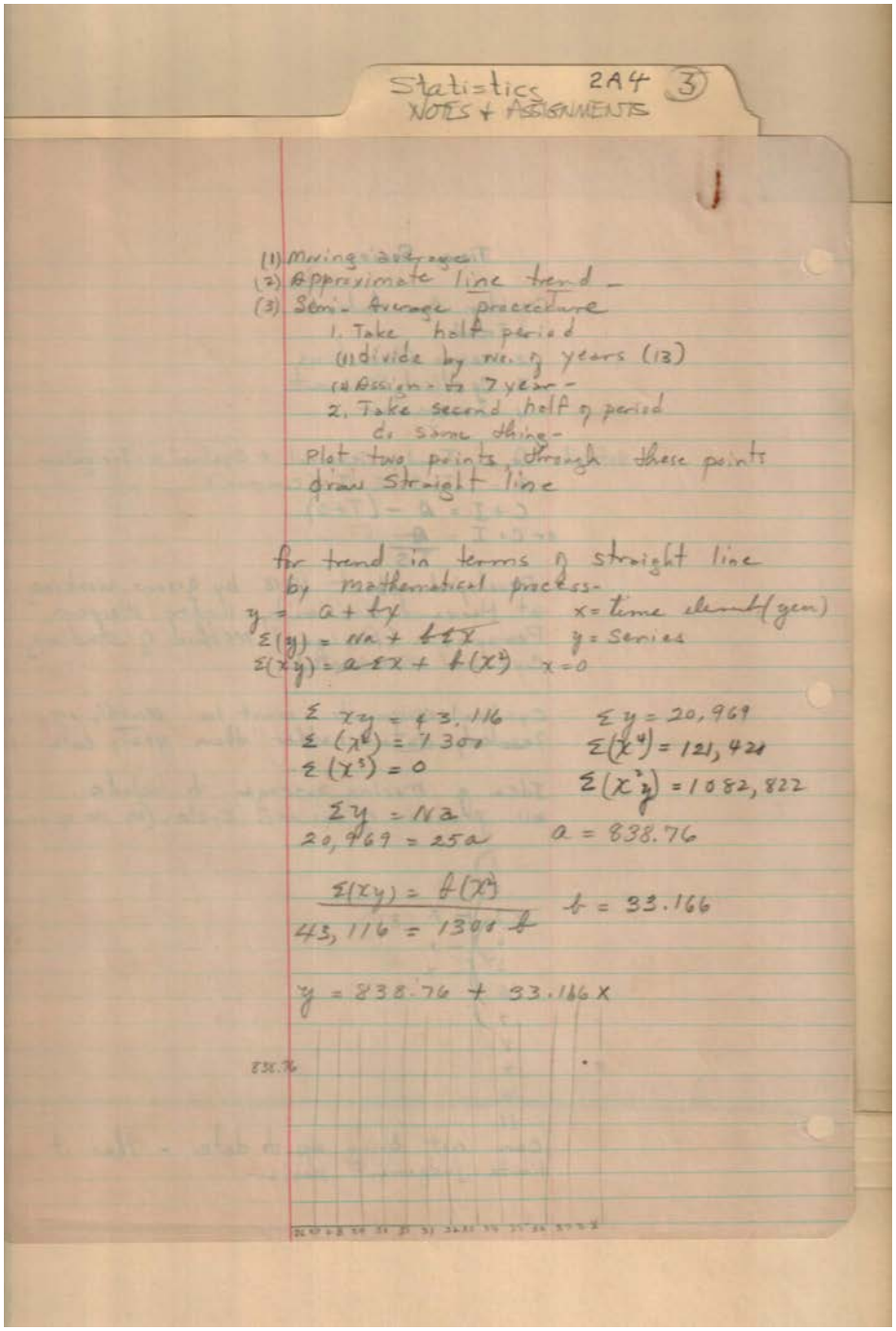

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Statistical Notes

Types:
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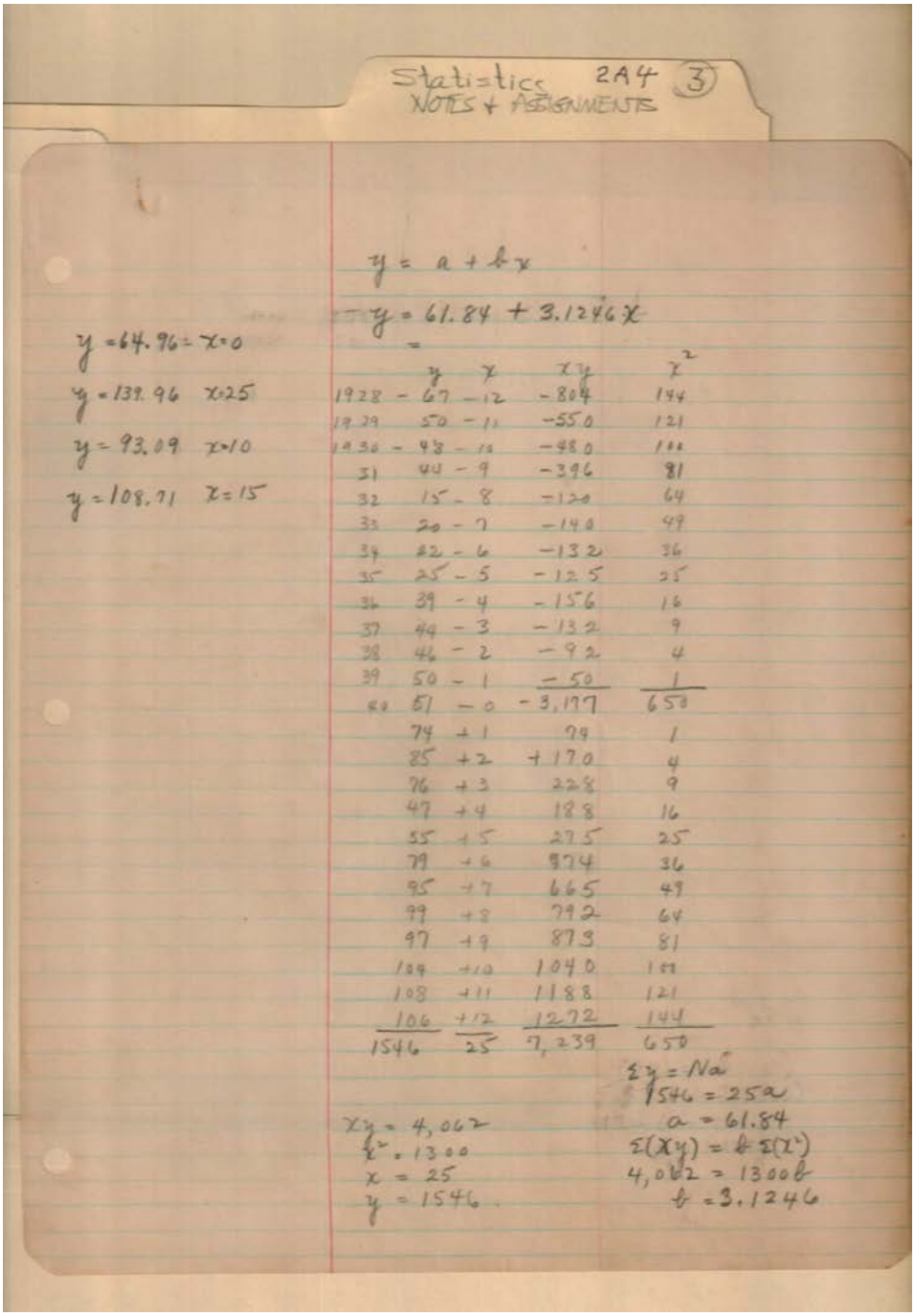

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Statistical Notes

Types:
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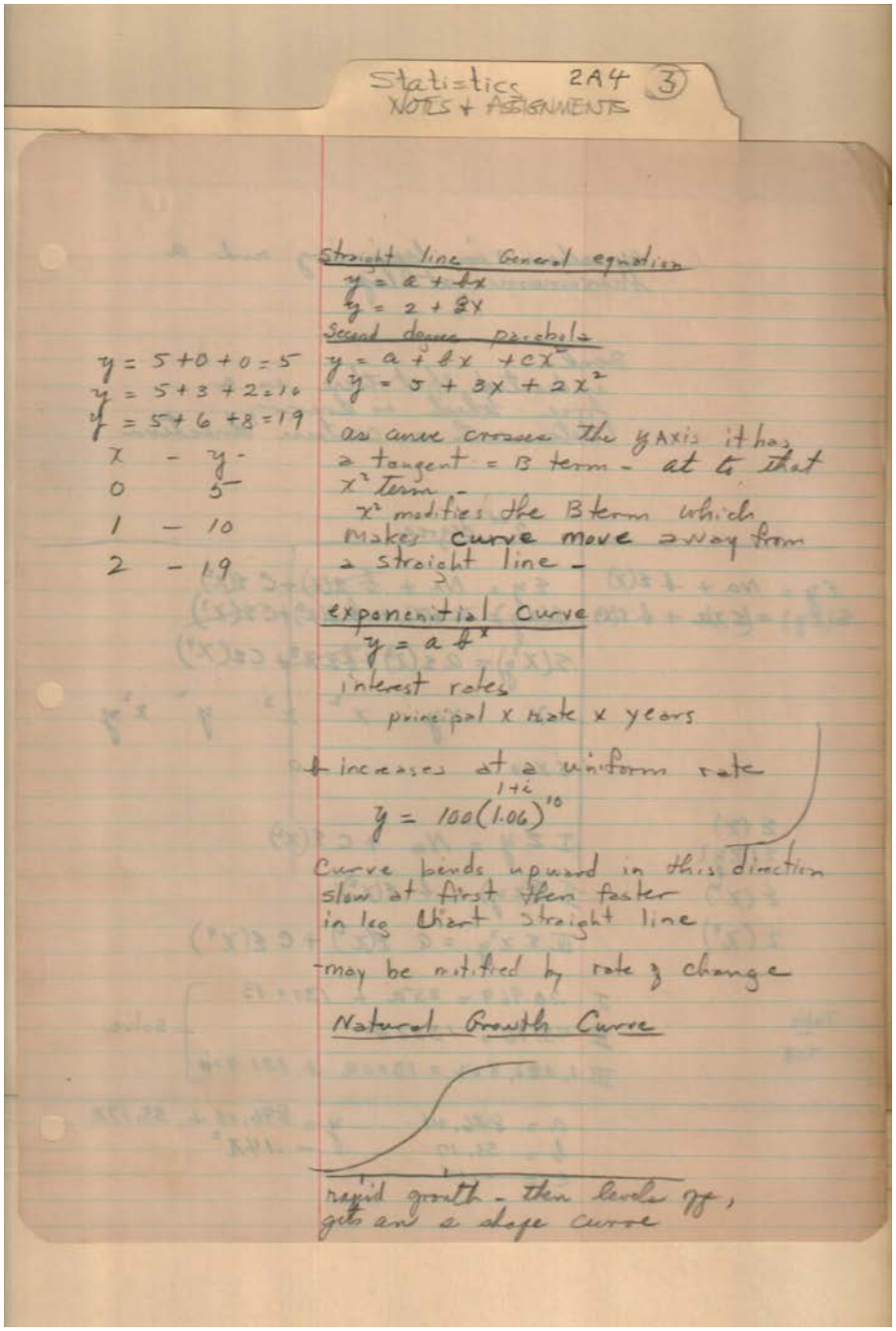

Names:
Statistical Notes

Types:
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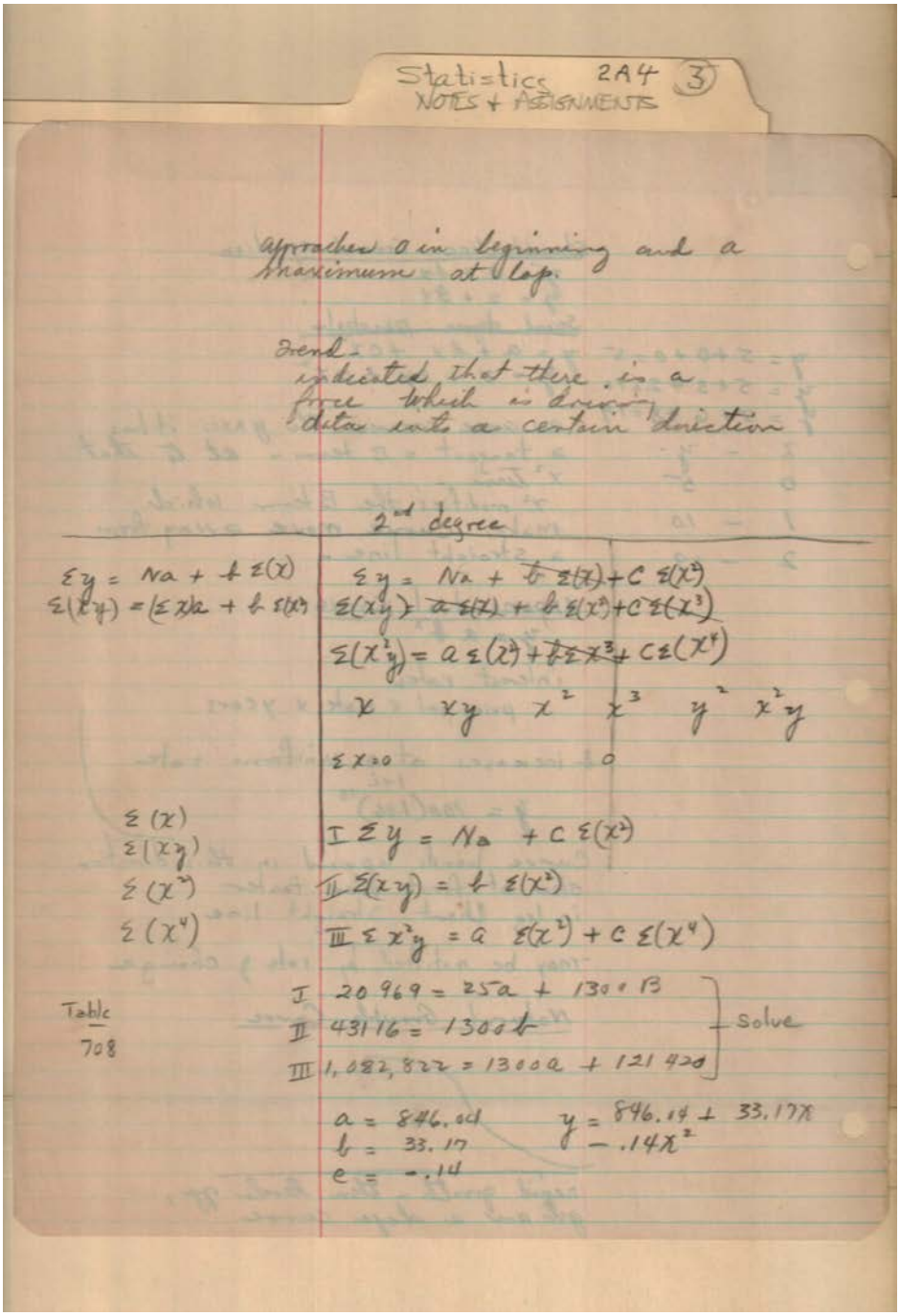

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Statistical Notes

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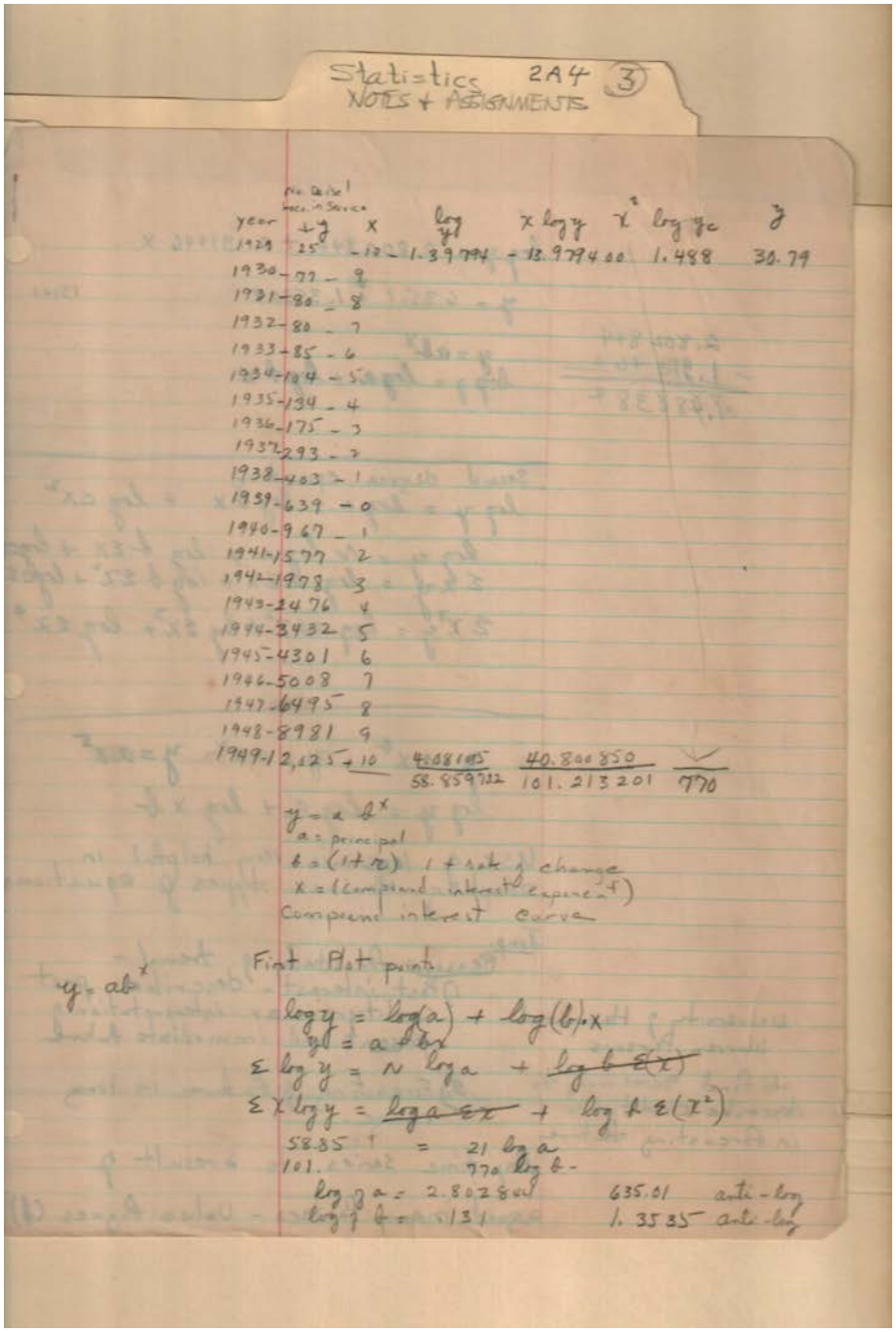
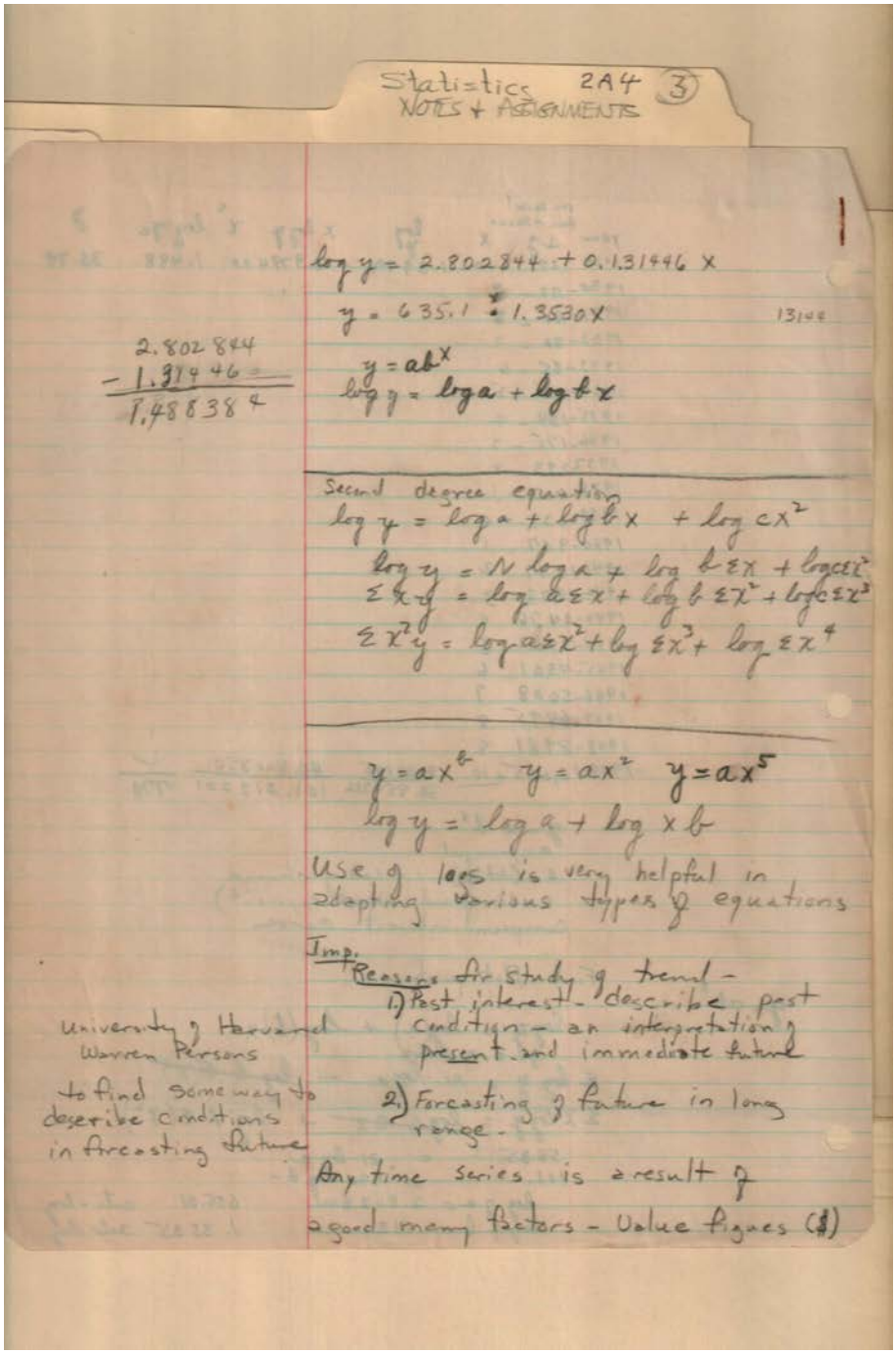


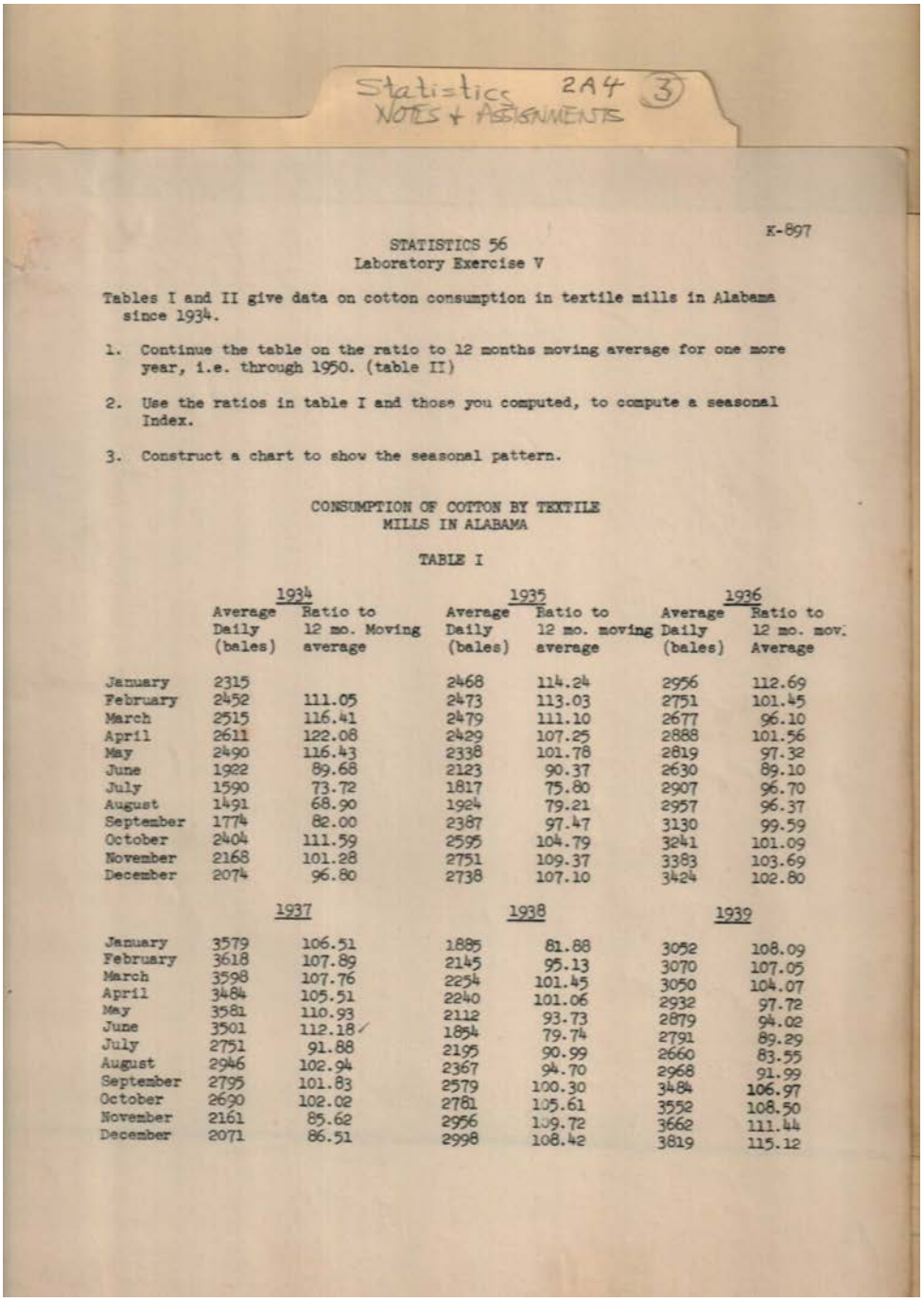
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-897

STATISTICS 56
Laboratory Exercise V

Tables I and II give data on cotton consumption in textile mills in Alabama since 1934.

1. Continue the table on the ratio to 12 months moving average for one more year, i.e. through 1950. (table II)

2. Use the ratios in table I and those you computed, to compute a seasonal Index.

3. Construct a chart to show the seasonal pattern.

CONSUMPTION OF COTTON BY TEXTILE MILLS IN ALABAMA

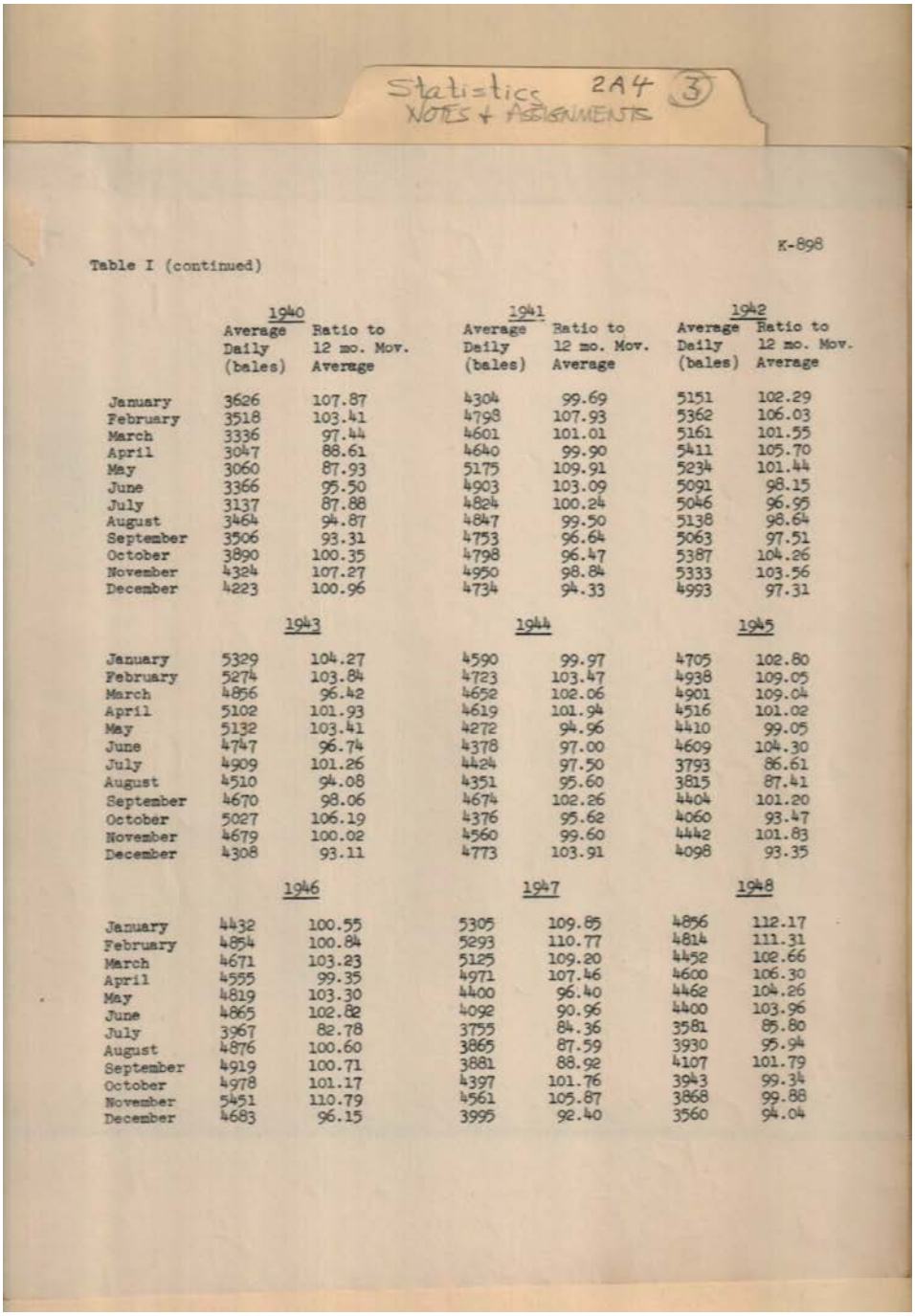
TABLE I

	1934		1935		1936	
	Average Daily (bales)	Ratio to 12 mo. Moving average	Average Daily (bales)	Ratio to 12 mo. moving average	Average Daily (bales)	Ratio to 12 mo. mov. Average
January	2315		2468	114.24	2956	112.69
February	2452	111.05	2473	113.03	2751	101.45
March	2515	116.41	2479	111.10	2677	96.10
April	2611	122.08	2429	107.25	2888	101.56
May	2490	116.43	2338	101.78	2819	97.32
June	1922	89.68	2123	90.37	2630	89.10
July	1590	73.72	1817	75.80	2907	96.70
August	1491	68.90	1924	79.21	2957	96.37
September	1774	82.00	2387	97.47	3130	99.59
October	2404	111.59	2595	104.79	3241	101.09
November	2168	101.28	2751	109.37	3383	103.69
December	2074	96.80	2738	107.10	3424	102.80

	1937		1938		1939	
January	3579	106.51	1885	81.88	3052	108.09
February	3618	107.89	2145	95.13	3070	107.05
March	3598	107.76	2254	101.45	3050	104.07
April	3484	105.51	2240	101.06	2932	97.72
May	3581	110.93	2112	93.73	2879	94.02
June	3501	112.18	1854	79.74	2791	89.29
July	2751	91.88	2195	90.99	2660	83.55
August	2946	102.94	2367	94.70	2968	91.99
September	2795	101.83	2579	100.30	3484	106.97
October	2690	102.02	2761	105.61	3552	108.50
November	2161	85.62	2956	109.72	3662	111.44
December	2071	86.51	2998	108.42	3819	115.12

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

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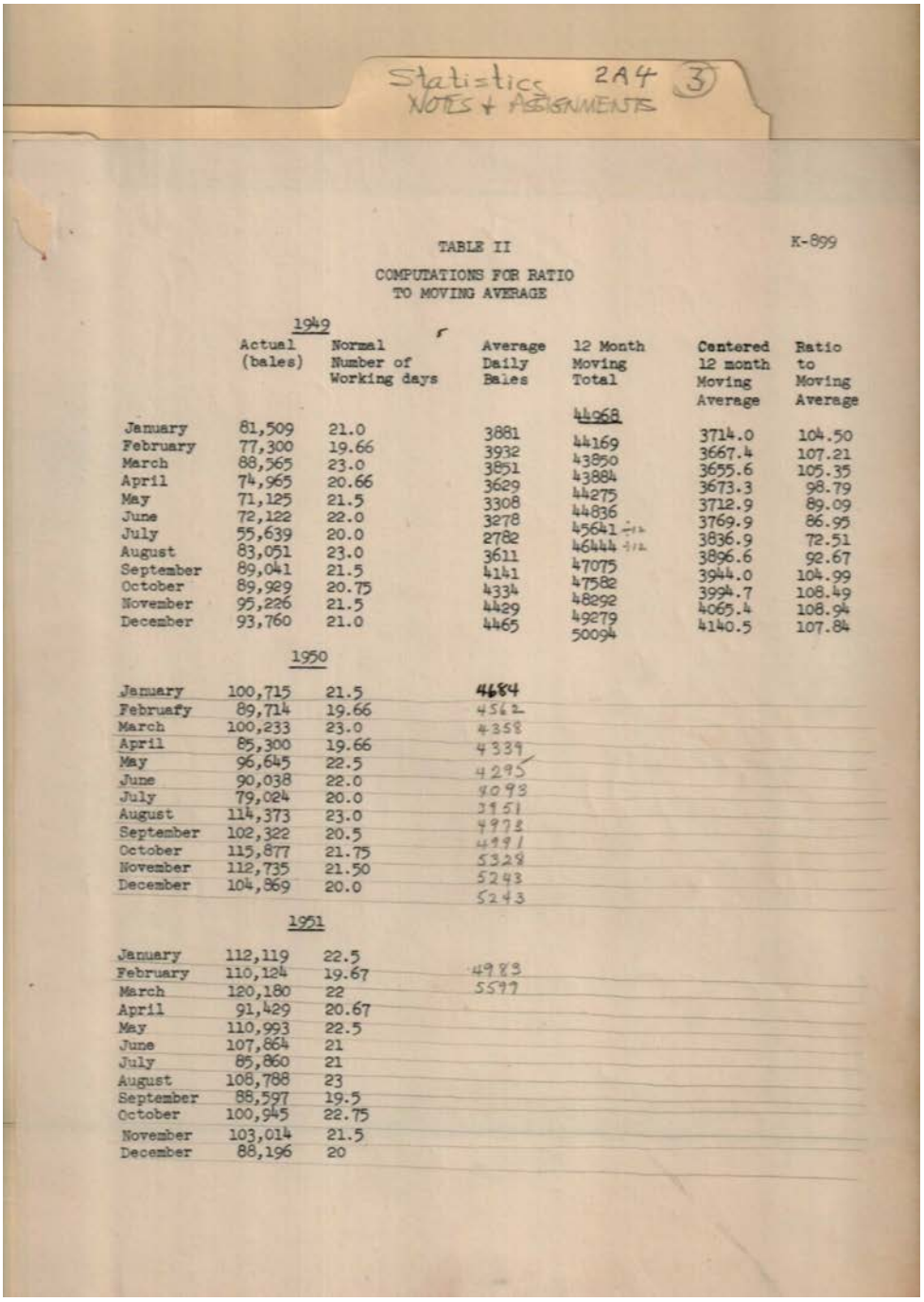
Table I (continued)

	1940 Average Daily (bales)	1940 Ratio to 12 mo. Mov. Average	1941 Average Daily (bales)	1941 Ratio to 12 mo. Mov. Average	1942 Average Daily (bales)	1942 Ratio to 12 mo. Mov. Average
January	3626	107.87	4304	99.69	5151	102.29
February	3518	103.41	4798	107.93	5362	106.03
March	3336	97.44	4601	101.01	5161	101.55
April	3047	88.61	4640	99.90	5411	105.70
May	3060	87.93	5175	109.91	5234	101.44
June	3366	95.50	4903	103.09	5091	98.15
July	3137	87.88	4824	100.24	5046	96.95
August	3464	94.87	4847	99.50	5138	98.64
September	3506	93.31	4753	96.64	5063	97.51
October	3890	100.35	4798	96.47	5387	104.26
November	4324	107.27	4950	98.84	5333	103.56
December	4223	100.96	4734	94.33	4993	97.31
	1943		1944		1945	
January	5329	104.27	4590	99.97	4705	102.80
February	5274	103.84	4723	103.47	4938	109.05
March	4856	96.42	4652	102.06	4901	109.04
April	5102	101.93	4619	101.94	4516	101.02
May	5132	103.41	4272	94.96	4410	99.05
June	4747	96.74	4378	97.00	4609	104.30
July	4909	101.26	4424	97.50	3793	86.61
August	4510	94.08	4351	95.60	3815	87.41
September	4670	98.06	4674	102.26	4404	101.20
October	5027	106.19	4376	95.62	4060	93.47
November	4679	100.02	4560	99.60	4442	101.83
December	4308	93.11	4773	103.91	4098	93.35
	1946		1947		1948	
January	4432	100.55	5305	109.85	4856	112.17
February	4854	100.84	5293	110.77	4814	111.31
March	4671	103.23	5125	109.20	4452	102.66
April	4555	99.35	4971	107.46	4600	106.30
May	4819	103.30	4400	96.40	4462	104.26
June	4865	102.82	4092	90.96	4400	103.96
July	3967	82.78	3755	84.36	3581	85.80
August	4876	100.60	3865	87.59	3930	95.94
September	4919	100.71	3881	88.92	4107	101.79
October	4978	101.17	4397	101.76	3943	99.34
November	5451	110.79	4561	105.87	3868	99.88
December	4683	96.15	3995	92.40	3560	94.04

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

TABLE II K-899

COMPUTATIONS FOR RATIO
TO MOVING AVERAGE

	Actual (bales)	Normal Number of Working days	Average Daily Bales	12 Month Moving Total	Centered 12 month Moving Average	Ratio to Moving Average
1949				44968		
January	81,509	21.0	3881		3714.0	104.50
February	77,300	19.66	3932	44169	3667.4	107.21
March	88,565	23.0	3851	43850	3655.6	105.35
April	74,965	20.66	3629	43884	3673.3	98.79
May	71,125	21.5	3308	44275	3712.9	89.09
June	72,122	22.0	3278	44836	3769.9	86.95
July	55,639	20.0	2782	45641 ½	3836.9	72.51
August	83,051	23.0	3611	46444 ½	3896.6	92.67
September	89,041	21.5	4141	47075	3944.0	104.99
October	89,929	20.75	4334	47582	3994.7	108.49
November	95,226	21.5	4429	48292	4065.4	108.94
December	93,760	21.0	4465	49279	4140.5	107.84
				50094		
1950						
January	100,715	21.5	4684			
Februafy	89,714	19.66	4562			
March	100,233	23.0	4358			
April	85,300	19.66	4339			
May	96,645	22.5	4295			
June	90,038	22.0	8093			
July	79,024	20.0	3951			
August	114,373	23.0	4973			
September	102,322	20.5	4991			
October	115,877	21.75	5328			
November	112,735	21.50	5243			
December	104,869	20.0	5243			
1951						
January	112,119	22.5				
February	110,124	19.67	4983			
March	120,180	22	5577			
April	91,429	20.67				
May	110,993	22.5				
June	107,864	21				
July	85,860	21				
August	108,788	23				
September	88,597	19.5				
October	100,945	22.75				
November	103,014	21.5				
December	88,196	20				

Names:
Statistical Notes

Types:
notes

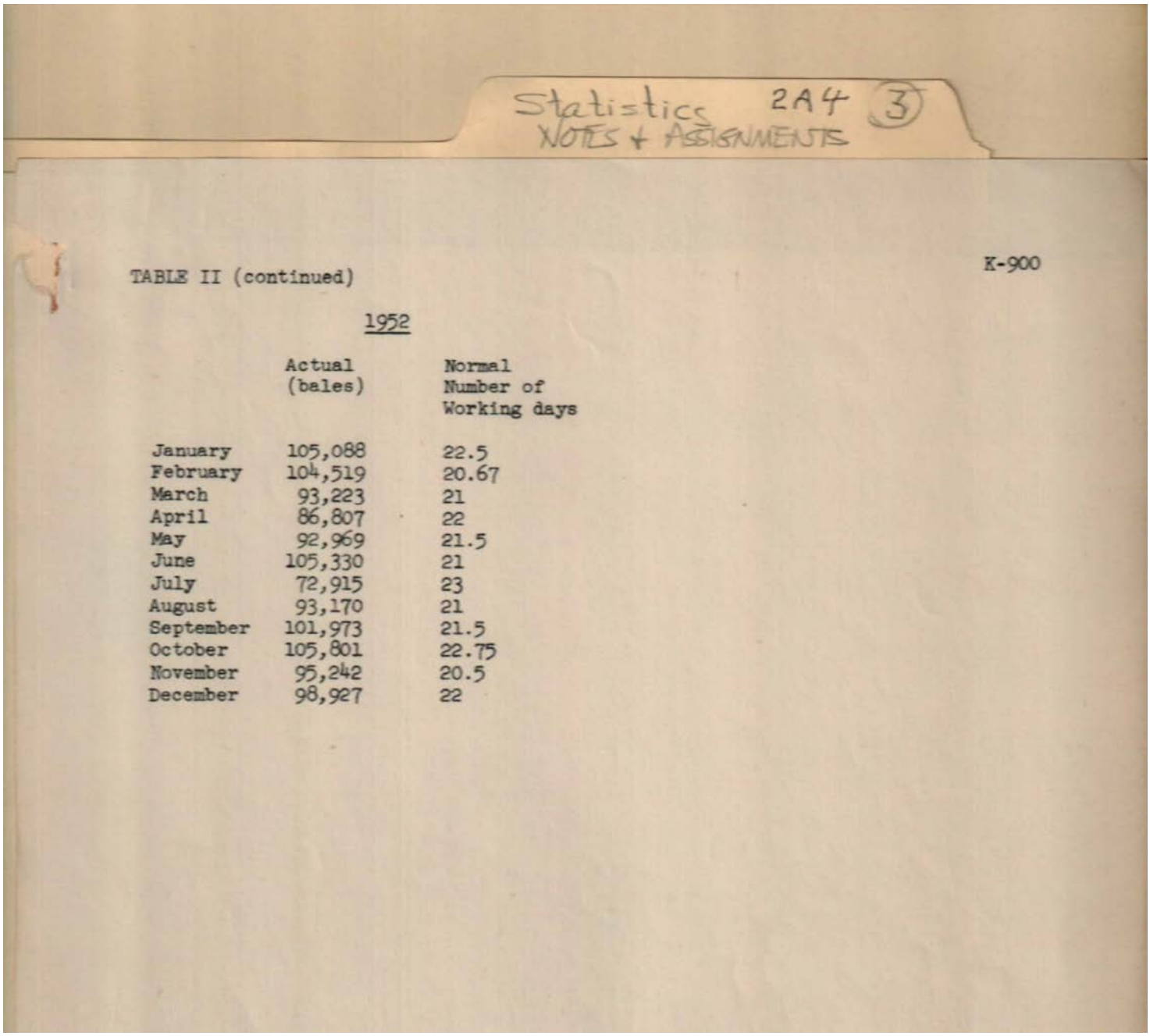


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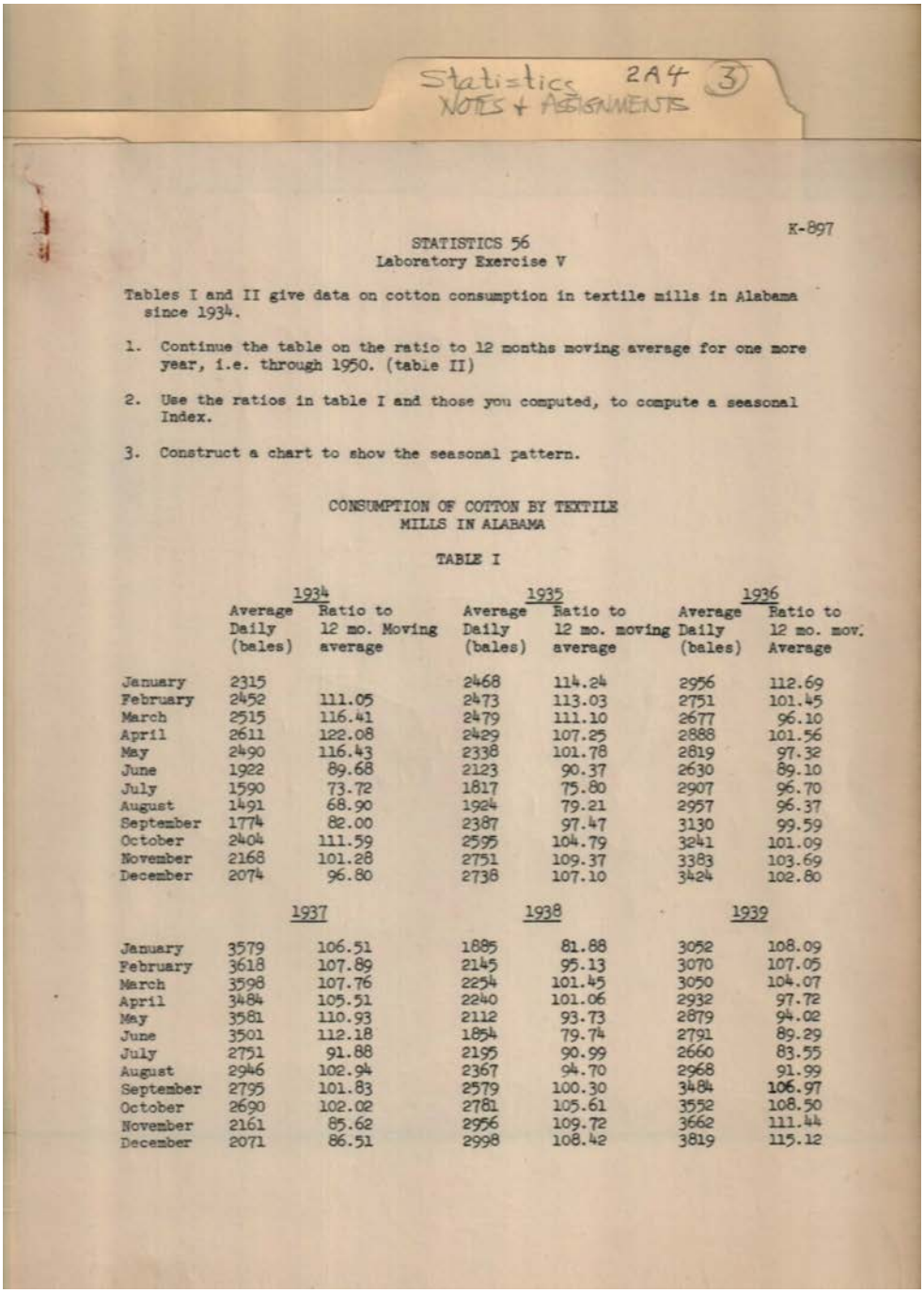
TABLE II (continued)

1952

	Actual (bales)	Normal Number of Working days
January	105,088	22.5
February	104,519	20.67
March	93,223	21
April	86,807	22
May	92,969	21.5
June	105,330	21
July	72,915	23
August	93,170	21
September	101,973	21.5
October	105,801	22.75
November	95,242	20.5
December	98,927	22

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-897

STATISTICS 56
Laboratory Exercise V

Tables I and II give data on cotton consumption in textile mills in Alabama since 1934.

1. Continue the table on the ratio to 12 months moving average for one more year, i.e. through 1950. (table II)

2. Use the ratios in table I and those you computed, to compute a seasonal Index.

3. Construct a chart to show the seasonal pattern.

CONSUMPTION OF COTTON BY TEXTILE MILLS IN ALABAMA

TABLE I

	1934		1935		1936	
	Average Daily (bales)	Ratio to 12 mo. Moving average	Average Daily (bales)	Ratio to 12 mo. moving average	Average Daily (bales)	Ratio to 12 mo. mov. Average
January	2315		2468	114.24	2956	112.69
February	2452	111.05	2473	113.03	2751	101.45
March	2515	116.41	2479	111.10	2677	96.10
April	2611	122.08	2429	107.25	2888	101.56
May	2490	116.43	2338	101.78	2819	97.32
June	1922	89.68	2123	90.37	2630	89.10
July	1590	73.72	1817	75.80	2907	96.70
August	1491	68.90	1924	79.21	2957	96.37
September	1774	82.00	2387	97.47	3130	99.59
October	2404	111.59	2595	104.79	3241	101.09
November	2168	101.28	2751	109.37	3383	103.69
December	2074	96.80	2738	107.10	3424	102.80
	1937		1938		1939	
January	3579	106.51	1885	81.88	3052	108.09
February	3618	107.89	2145	95.13	3070	107.05
March	3598	107.76	2254	101.45	3050	104.07
April	3484	105.51	2240	101.06	2932	97.72
May	3581	110.93	2112	93.73	2879	94.02
June	3501	112.18	1854	79.74	2791	89.29
July	2751	91.88	2195	90.99	2660	83.55
August	2946	102.94	2367	94.70	2968	91.99
September	2795	101.83	2579	100.30	3484	106.97
October	2690	102.02	2781	105.61	3552	108.50
November	2161	85.62	2956	109.72	3662	111.44
December	2071	86.51	2998	108.42	3819	115.12

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Statistical Notes

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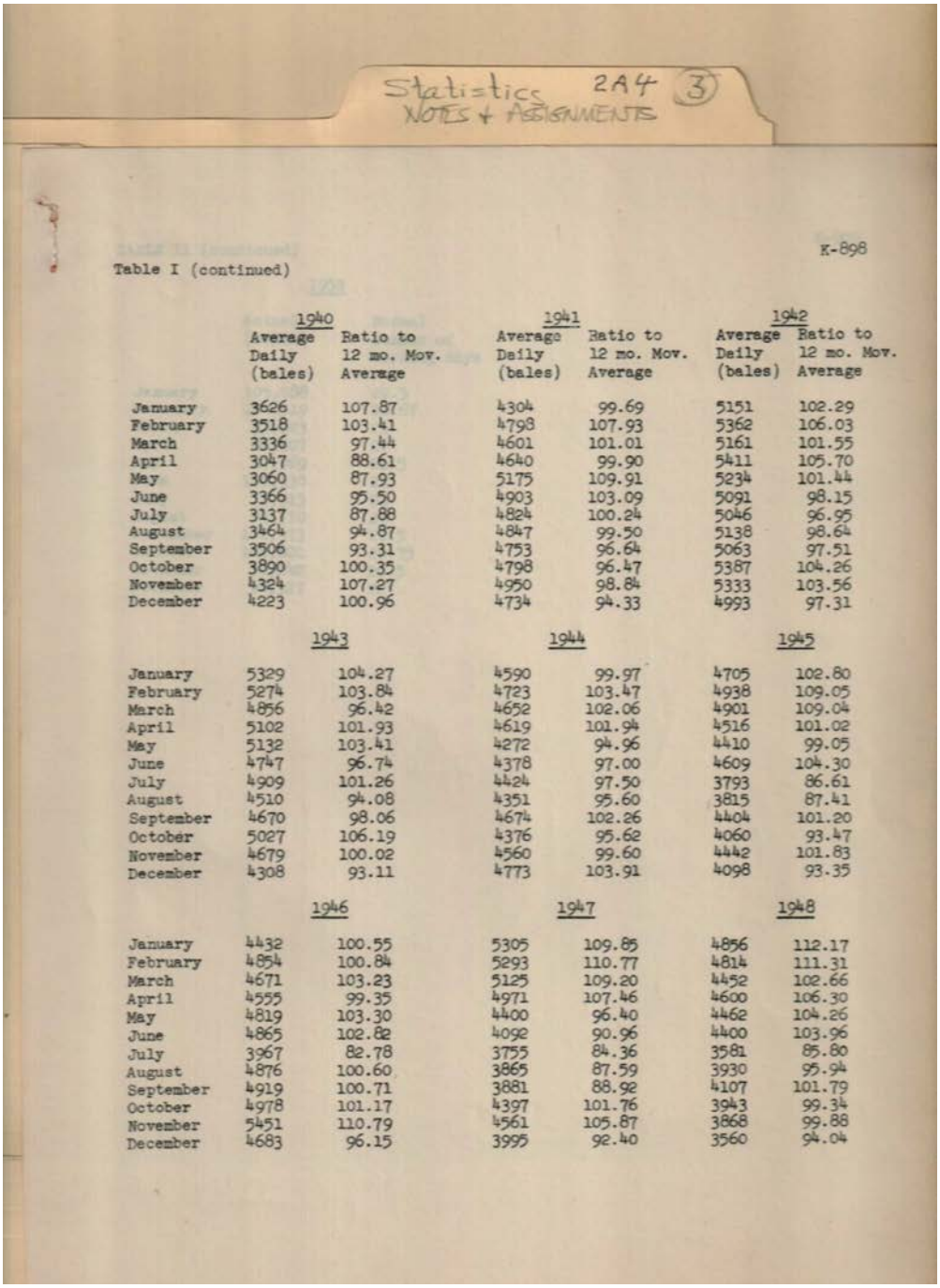
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-898

Table I (continued)

	1940 Average Daily (bales)	1940 Ratio to 12 mo. Mov. Average	1941 Average Daily (bales)	1941 Ratio to 12 mo. Mov. Average	1942 Average Daily (bales)	1942 Ratio to 12 mo. Mov. Average
January	3626	107.87	4304	99.69	5151	102.29
February	3518	103.41	4798	107.93	5362	106.03
March	3336	97.44	4601	101.01	5161	101.55
April	3047	88.61	4640	99.90	5411	105.70
May	3060	87.93	5175	109.91	5234	101.44
June	3366	95.50	4903	103.09	5091	98.15
July	3137	87.88	4824	100.24	5046	96.95
August	3464	94.87	4847	99.50	5138	98.64
September	3506	93.31	4753	96.64	5063	97.51
October	3890	100.35	4798	96.47	5387	104.26
November	4324	107.27	4950	98.84	5333	103.56
December	4223	100.96	4734	94.33	4993	97.31
	1943		1944		1945	
January	5329	104.27	4590	99.97	4705	102.80
February	5274	103.84	4723	103.47	4938	109.05
March	4856	96.42	4652	102.06	4901	109.04
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May	5132	103.41	4272	94.96	4410	99.05
June	4747	96.74	4378	97.00	4609	104.30
July	4909	101.26	4424	97.50	3793	86.61
August	4510	94.08	4351	95.60	3815	87.41
September	4670	98.06	4674	102.26	4404	101.20
October	5027	106.19	4376	95.62	4060	93.47
November	4679	100.02	4560	99.60	4442	101.83
December	4308	93.11	4773	103.91	4098	93.35
	1946		1947		1948	
January	4432	100.55	5305	109.85	4856	112.17
February	4854	100.84	5293	110.77	4814	111.31
March	4671	103.23	5125	109.20	4452	102.66
April	4555	99.35	4971	107.46	4600	106.30
May	4819	103.30	4400	96.40	4462	104.26
June	4865	102.82	4092	90.96	4400	103.96
July	3967	82.78	3755	84.36	3581	85.80
August	4876	100.60	3865	87.59	3930	95.94
September	4919	100.71	3881	88.92	4107	101.79
October	4978	101.17	4397	101.76	3943	99.34
November	5451	110.79	4561	105.87	3868	99.88
December	4683	96.15	3995	92.40	3560	94.04

Names:
Statistical Notes

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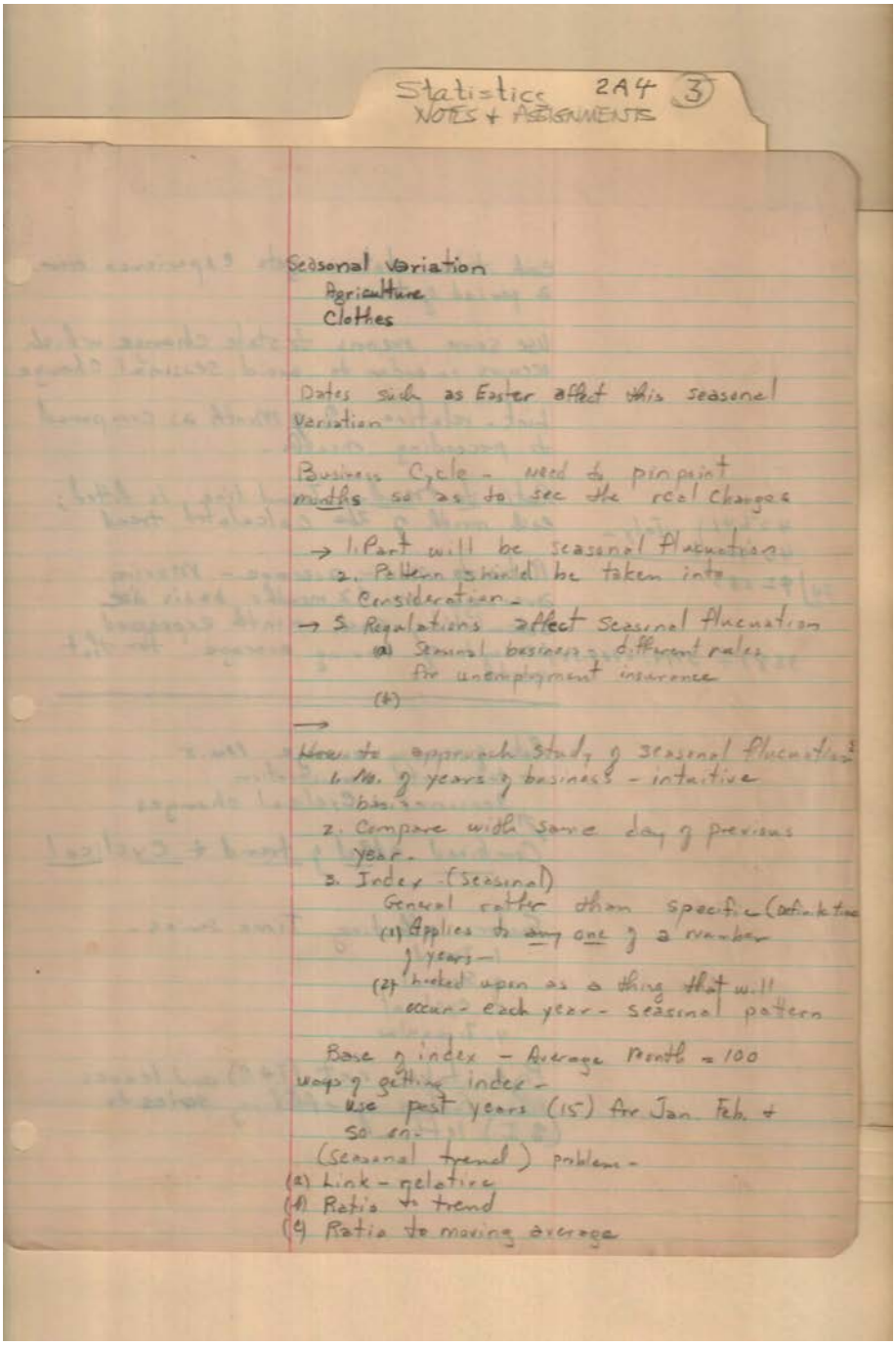
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Seasonal variation
Agriculture
Clothes

Dates such as Easter affect this seasonal variation

Business Cycle - need to pinpoint months so as to see the real changes

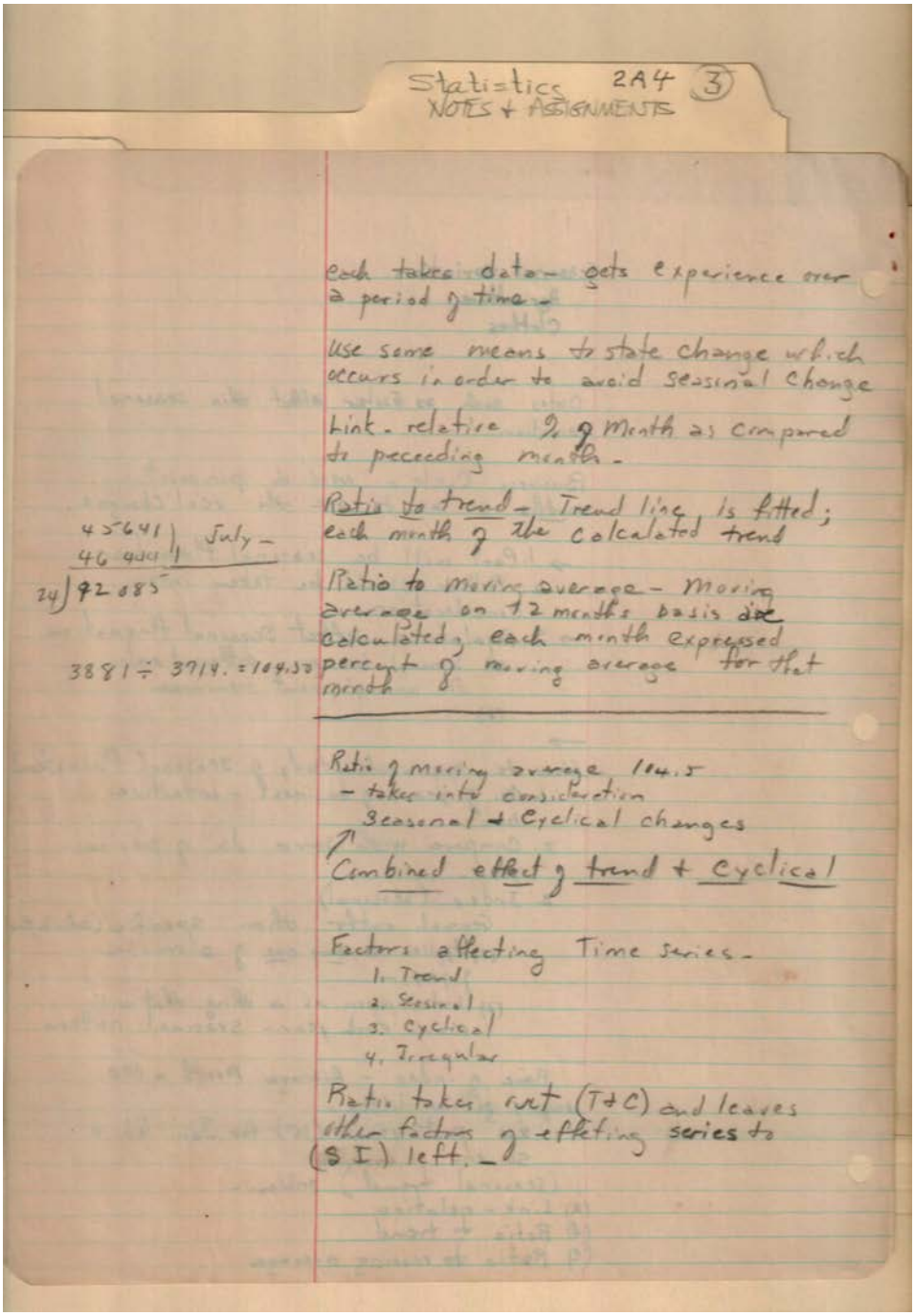
→ 1. Part will be seasonal fluctuations
2. Pattern should be taken into consideration -
→ 3. Regulations affect Seasonal fluctuations
(a) Seasonal business - different rules for unemployment insurance
(b)
→

How to approach study of seasonal fluctuations
1. No. of years of business - intuitive basis
2. Compare with same day of previous year.
3. Index (Seasonal)
General rather than specific (definite time)
(1) Applies to ~~any~~ one of a number of years -
(2) Looked upon as a thing that will occur each year - seasonal pattern

Base of index - Average Month = 100
ways of getting index -
use past years (15) for Jan. Feb. + so on.
(Seasonal trend) problem -
(a) Link - relative
(b) Ratio to trend
(c) Ratio to moving average

Names:
Statistical Notes

Types:
notes



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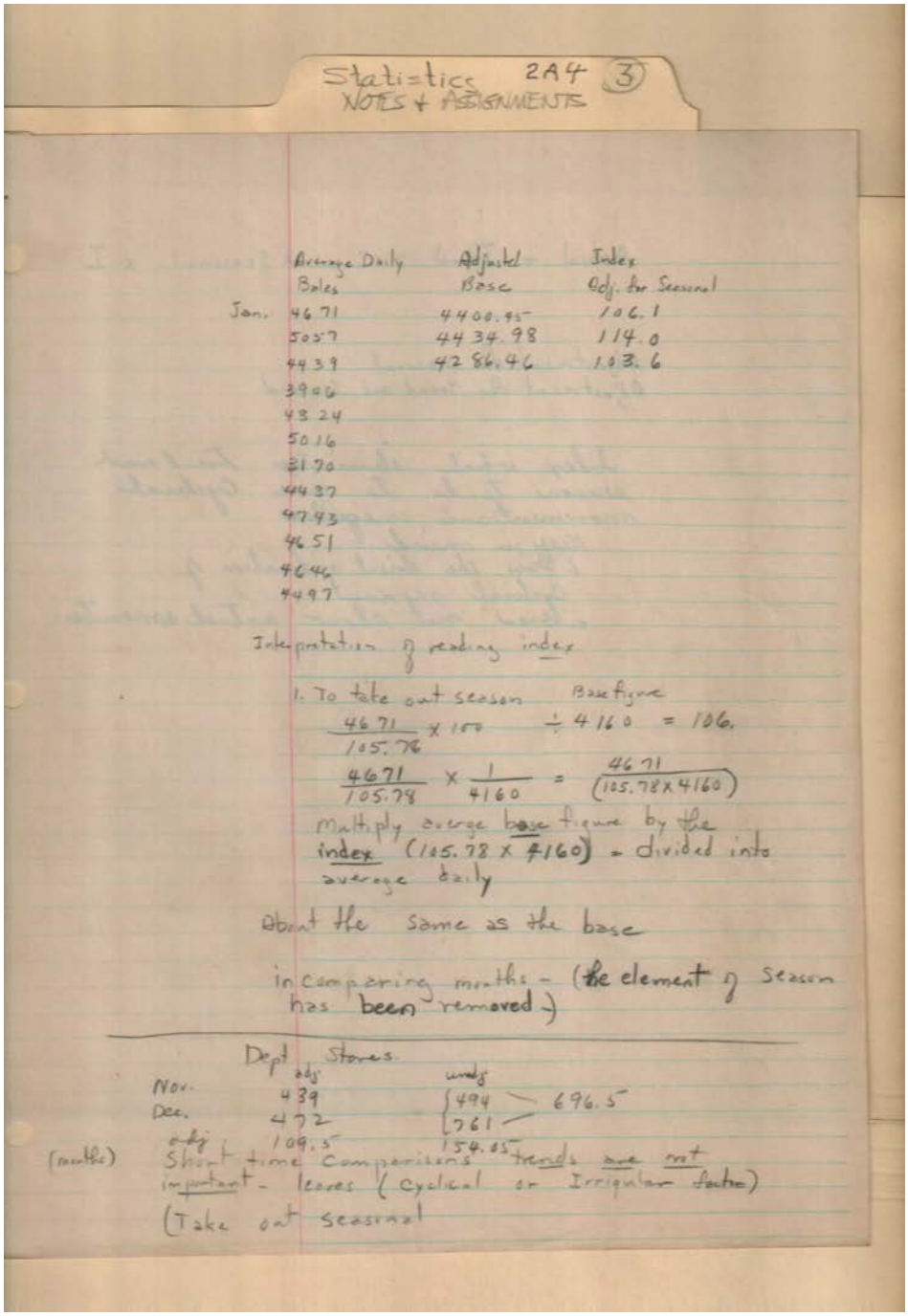


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

	Average Daily Bales	Adjusted Base	Index Adj. for Seasonal
Jan.	4671	4400.95	106.1
	5057	4434.98	114.0
	4439	4286.46	103.6
	3906		
	4324		
	5016		
	3170		
	4437		
	4743		
	4651		
	4646		
	4497		

Interpretation of reading index

1. To take out season Base figure

$\frac{4671}{105.78} \times 100 \div 4160 = 106.$

$\frac{4671}{105.78} \times \frac{1}{4160} = \frac{4671}{(105.78 \times 4160)}$

Multiply average base figure by the index (105.78 x 4160) = divided into average daily

About the same as the base

in comparing months - (the element of season has been removed)

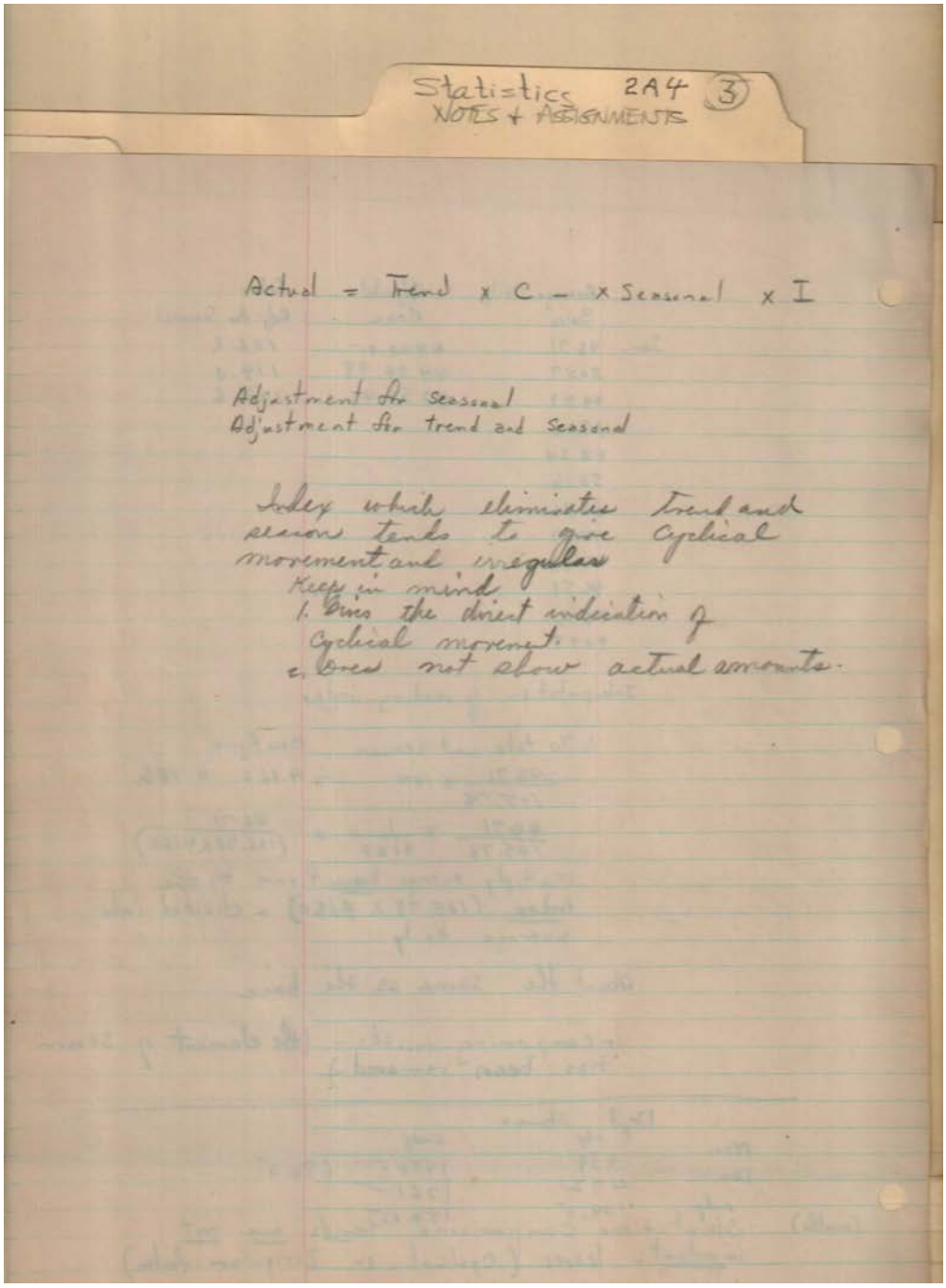
Dept Stores

	adj	unadj	
Nov.	439	494	696.5
Dec.	472	761	
(months)	109.5	154.05	

Short time comparisons trends are not important - leaves (cyclical or Irregular factor)
(Take out seasonal

Names:
Statistical Notes

Types:
notes



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Statistical Notes

Types:
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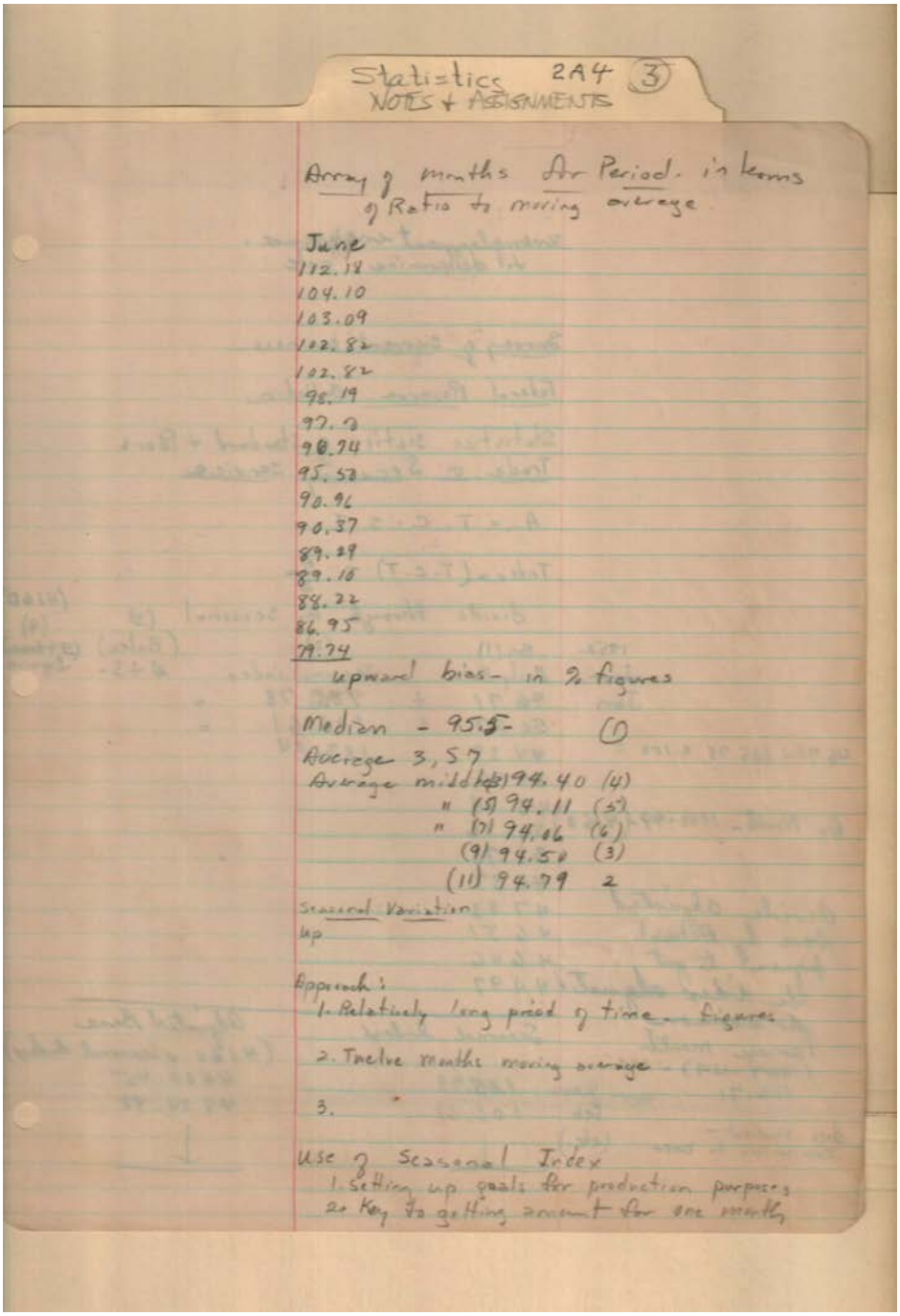

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Statistical Notes

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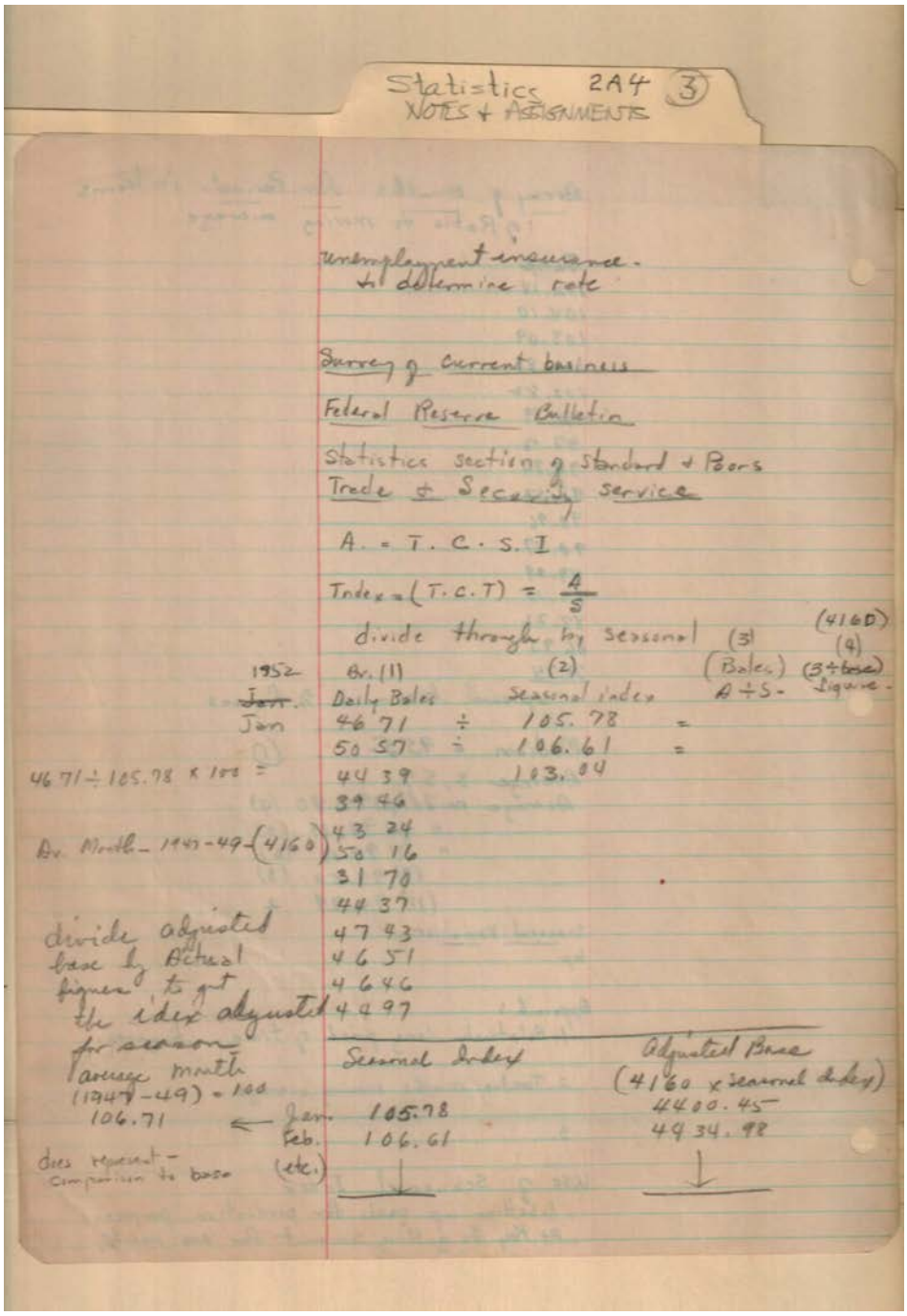

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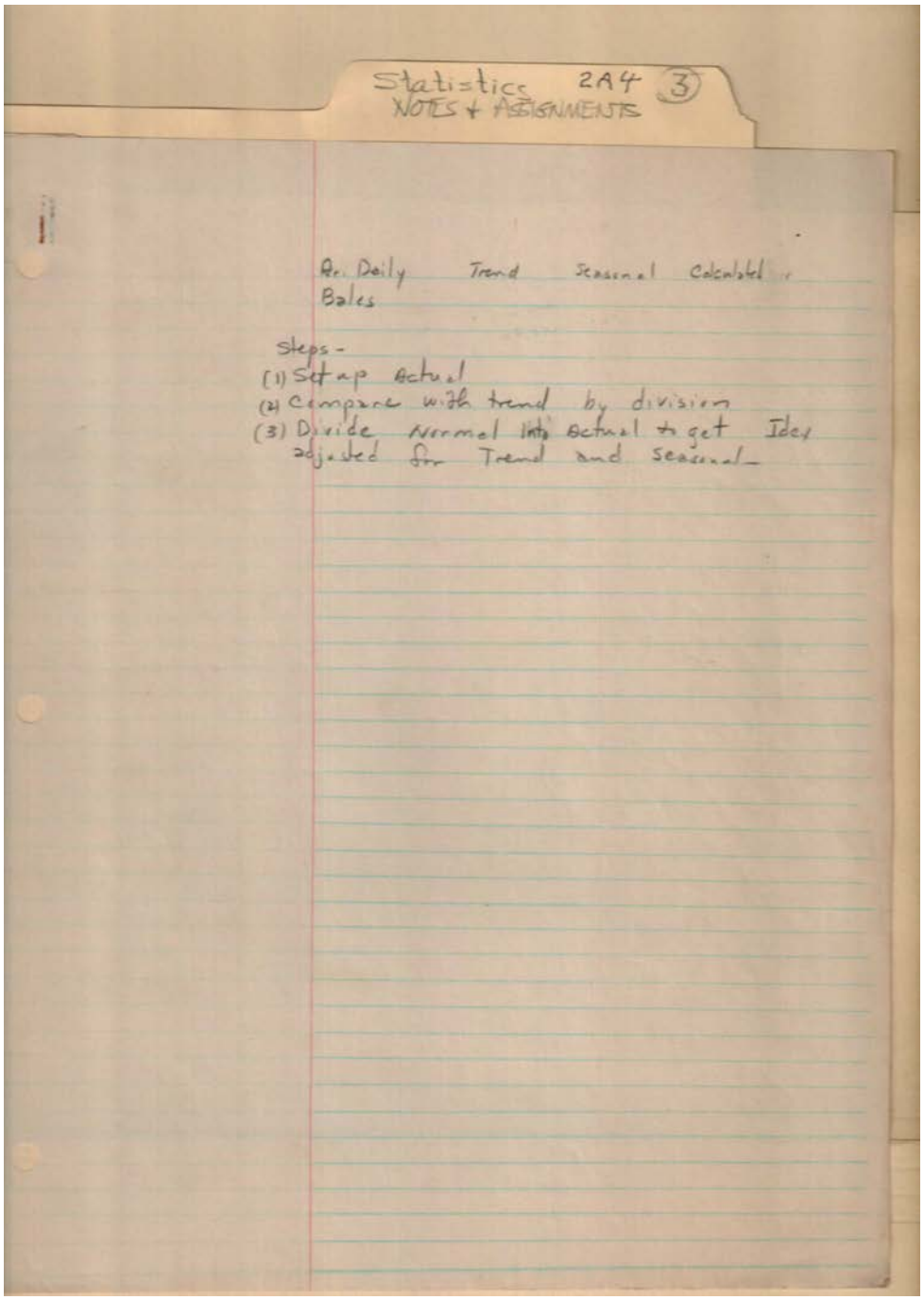

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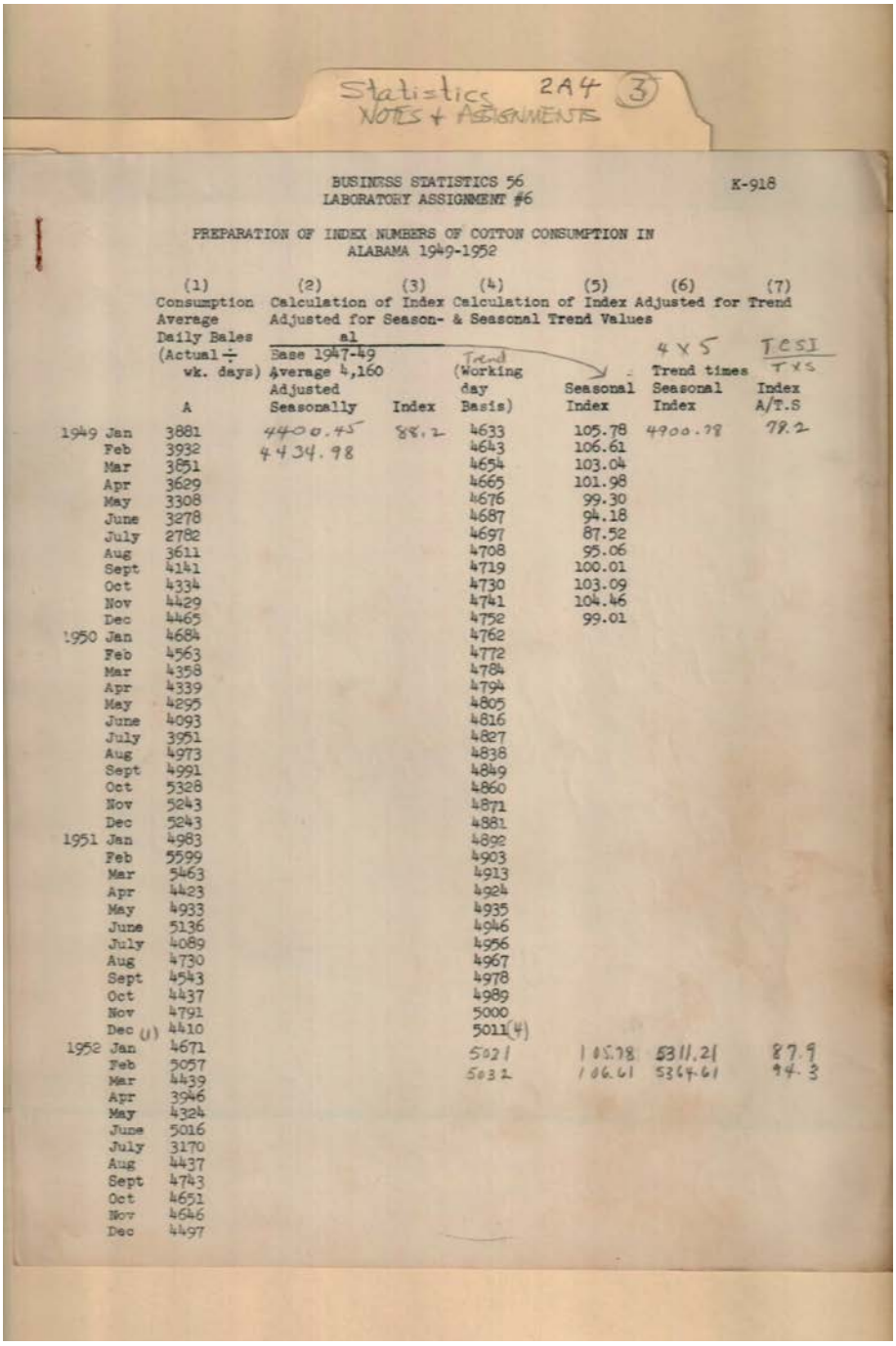


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

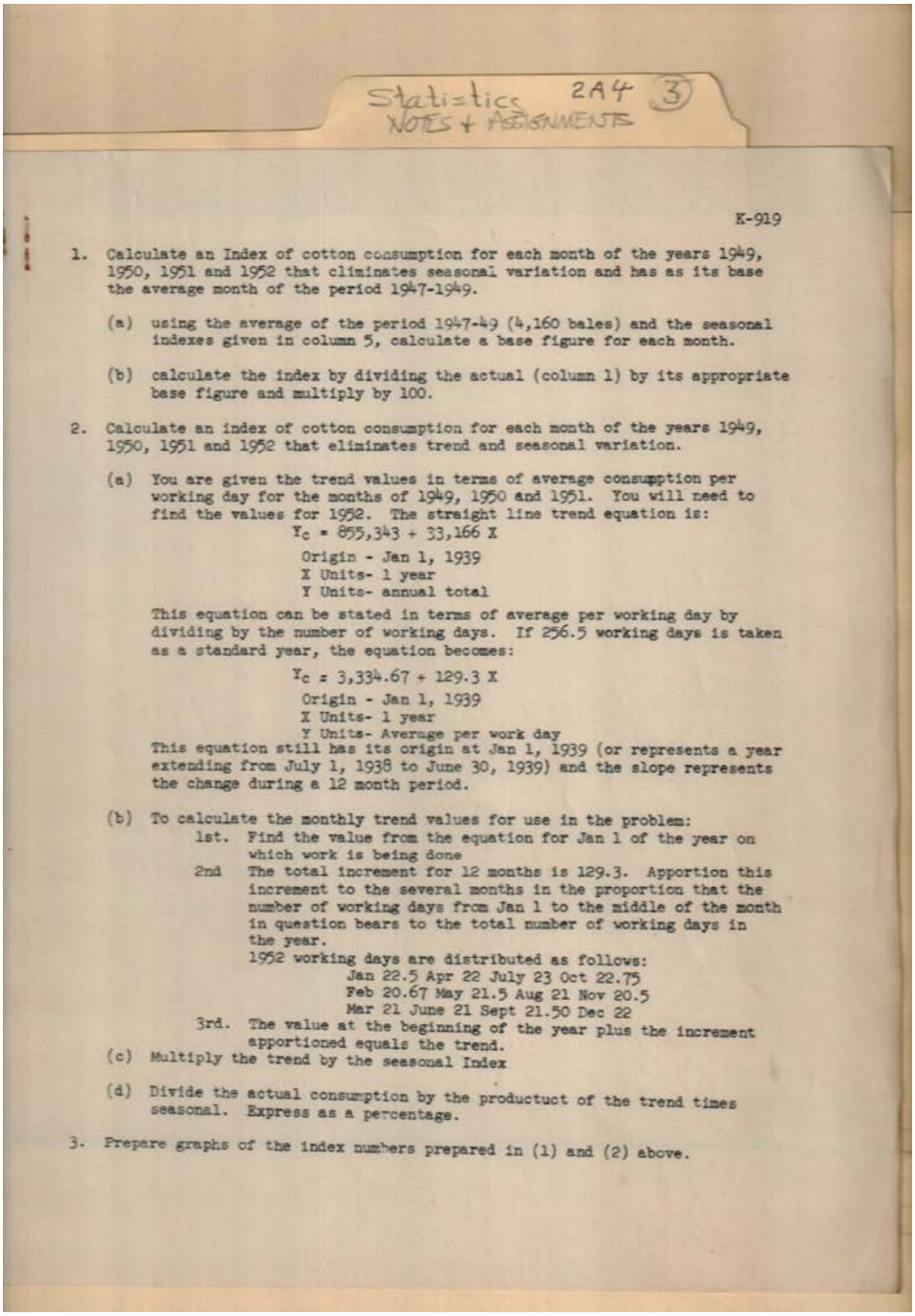
BUSINESS STATISTICS 56 K-918
LABORATORY ASSIGNMENT #6

PREPARATION OF INDEX NUMBERS OF COTTON CONSUMPTION IN ALABAMA 1949-1952

		(1) Consumption Average Daily Bales (Actual ÷ wk. days) A	(2) Calculation of Index Adjusted for Seasonal Base 1947-49 Average 4,160 Adjusted Seasonally	(3) Index	(4) Calculation of Index & Seasonal Trend Values Trend (Working day Basis)	(5) Seasonal Index	(6) Adjusted for Trend 4 x 5 Trend times Seasonal Index	(7) T c s i / T x s Index A/T.S
1949	Jan	3881	4400.45	88.2	4633	105.78	4900.78	79.2
	Feb	3932	4434.98		4643	106.61		
	Mar	3851			4654	103.04		
	Apr	3629			4665	101.98		
	May	3308			4676	99.30		
	June	3278			4687	94.18		
	July	2782			4697	87.52		
	Aug	3611			4708	95.06		
	Sept	4141			4719	100.01		
	Oct	4334			4730	103.09		
	Nov	4429			4741	104.46		
	Dec	4465			4752	99.01		
1950	Jan	4684			4762			
	Feb	4563			4772			
	Mar	4358			4784			
	Apr	4339			4794			
	May	4295			4805			
	June	4093			4816			
	July	3951			4827			
	Aug	4973			4838			
	Sept	4991			4849			
	Oct	5328			4860			
	Nov	5243			4871			
	Dec	5243			4881			
1951	Jan	4983			4892			
	Feb	5599			4903			
	Mar	5463			4913			
	Apr	4423			4924			
	May	4933			4935			
	June	5136			4946			
	July	4089			4956			
	Aug	4730			4967			
	Sept	4543			4978			
	Oct	4437			4989			
	Nov	4791			5000			
	Dec (1)	4410			5011 (4)			
1952	Jan	4671			5021	105.78	5311.21	87.9
	Feb	5057			5032	106.61	5364.61	94.3
	Mar	4439						
	Apr	3946						
	May	4324						
	June	5016						
	July	3170						
	Aug	4437						
	Sept	4743						
	Oct	4651						
	Nov	4646						
	Dec	4497						

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-919

1. Calculate an Index of cotton consumption for each month of the years 1949, 1950, 1951 and 1952 that eliminates seasonal variation and has as its base the average month of the period 1947-1949.

   (a) using the average of the period 1947-49 (4,160 bales) and the seasonal indexes given in column 5, calculate a base figure for each month.

   (b) calculate the index by dividing the actual (column 1) by its appropriate base figure and multiply by 100.

2. Calculate an index of cotton consumption for each month of the years 1949, 1950, 1951 and 1952 that eliminates trend and seasonal variation.

   (a) You are given the trend values in terms of average consumption per working day for the months of 1949, 1950 and 1951. You will need to find the values for 1952. The straight line trend equation is:

   $$Y_c = 855,343 + 33,166\ X$$

   Origin - Jan 1, 1939
   X Units- 1 year
   Y Units- annual total

   This equation can be stated in terms of average per working day by dividing by the number of working days. If 256.5 working days is taken as a standard year, the equation becomes:

   $$Y_c = 3,334.67 + 129.3\ X$$

   Origin - Jan 1, 1939
   X Units- 1 year
   Y Units- Average per work day

   This equation still has its origin at Jan 1, 1939 (or represents a year extending from July 1, 1938 to June 30, 1939) and the slope represents the change during a 12 month period.

   (b) To calculate the monthly trend values for use in the problem:
   1st. Find the value from the equation for Jan 1 of the year on which work is being done
   2nd The total increment for 12 months is 129.3. Apportion this increment to the several months in the proportion that the number of working days from Jan 1 to the middle of the month in question bears to the total number of working days in the year.
   1952 working days are distributed as follows:
   Jan 22.5 Apr 22 July 23 Oct 22.75
   Feb 20.67 May 21.5 Aug 21 Nov 20.5
   Mar 21 June 21 Sept 21.50 Dec 22
   3rd. The value at the beginning of the year plus the increment apportioned equals the trend.

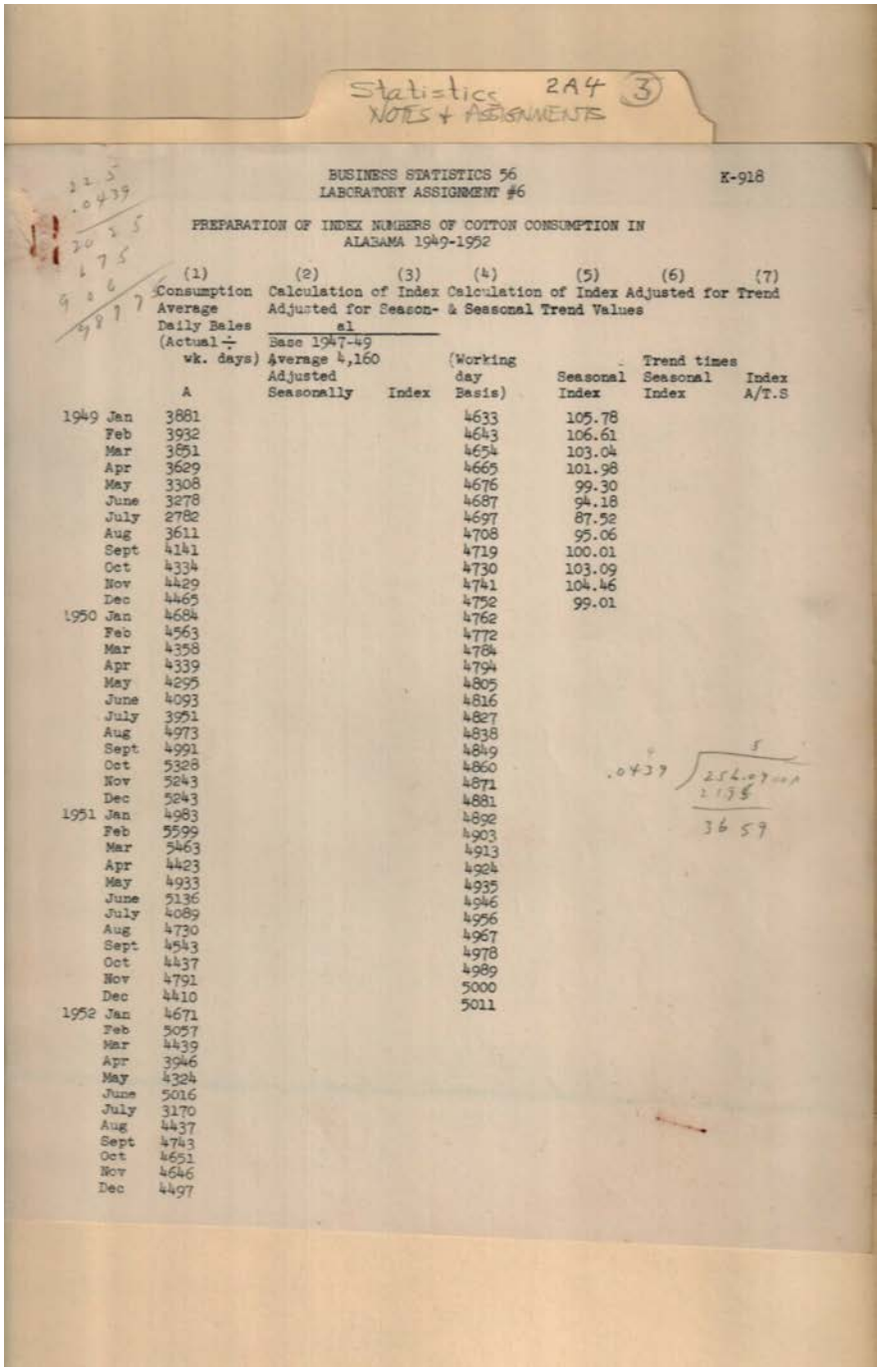
   (c) Multiply the trend by the seasonal Index

   (d) Divide the actual consumption by the productuct of the trend times seasonal. Express as a percentage.

3. Prepare graphs of the index numbers prepared in (1) and (2) above.

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

BUSINESS STATISTICS 56 K-918
LABORATORY ASSIGNMENT #6

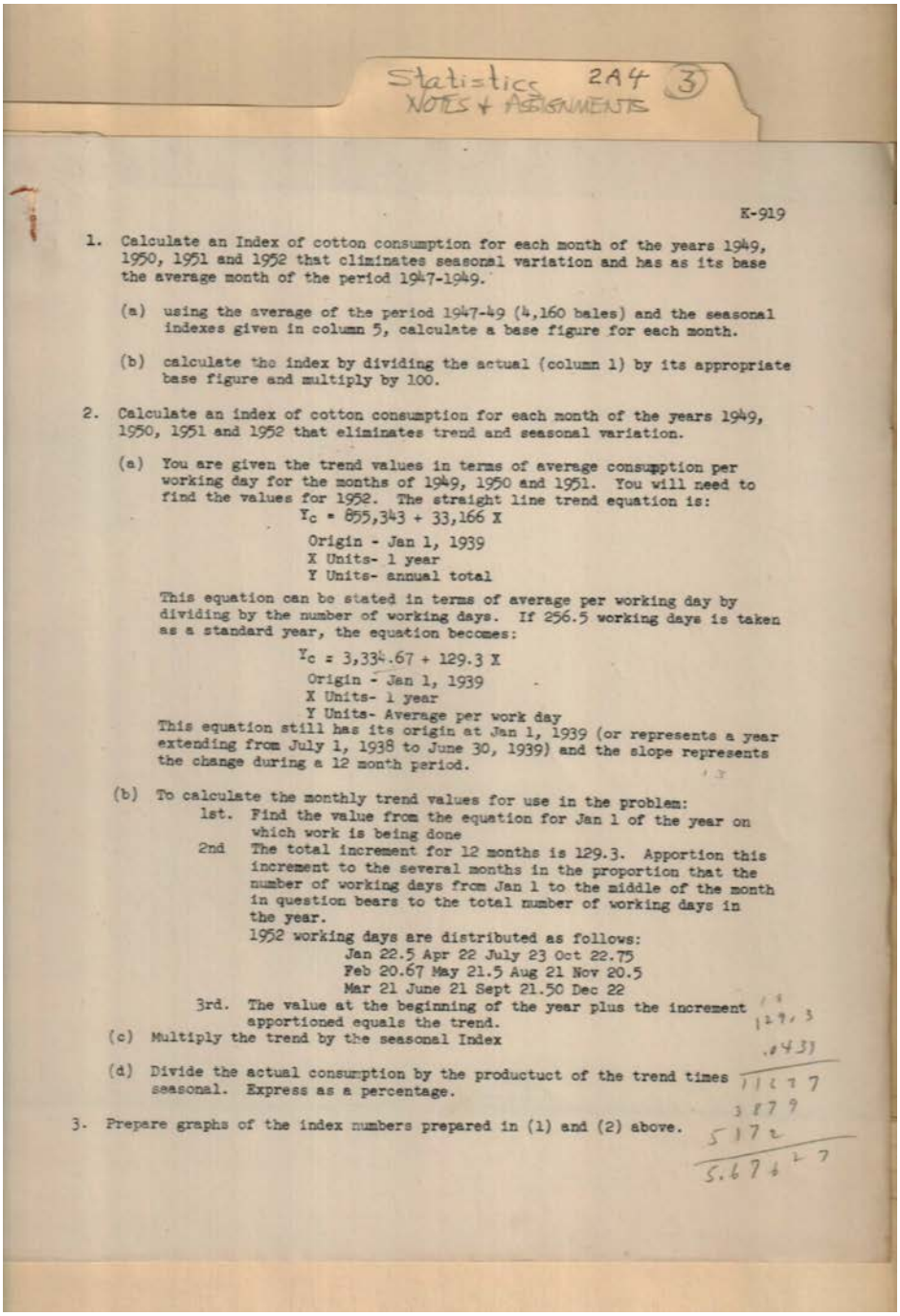
PREPARATION OF INDEX NUMBERS OF COTTON CONSUMPTION IN ALABAMA 1949-1952

		(1) Consumption Average Daily Bales (Actual ÷ wk. days) A	(2) Calculation of Index Adjusted for Seasonal Base 1947-49 Average 4,160 Adjusted Seasonally	(3) Index	(4) Calculation of Index & Seasonal Trend Values (Working day Basis)	(5) Seasonal Index	(6) Adjusted for Trend Trend times Seasonal Index	(7) Index A/T.S
1949	Jan	3881			4633	105.78		
	Feb	3932			4643	106.61		
	Mar	3851			4654	103.04		
	Apr	3629			4665	101.98		
	May	3308			4676	99.30		
	June	3278			4687	94.18		
	July	2782			4697	87.52		
	Aug	3611			4708	95.06		
	Sept	4141			4719	100.01		
	Oct	4334			4730	103.09		
	Nov	4429			4741	104.46		
	Dec	4465			4752	99.01		
1950	Jan	4684			4762			
	Feb	4563			4772			
	Mar	4358			4784			
	Apr	4339			4794			
	May	4295			4805			
	June	4093			4816			
	July	3951			4827			
	Aug	4973			4838			
	Sept	4991			4849			
	Oct	5328			4860			
	Nov	5243			4871			
	Dec	5243			4881			
1951	Jan	4983			4892			
	Feb	5599			4903			
	Mar	5463			4913			
	Apr	4423			4924			
	May	4933			4935			
	June	5136			4946			
	July	4089			4956			
	Aug	4730			4967			
	Sept	4543			4978			
	Oct	4437			4989			
	Nov	4791			5000			
	Dec	4410			5011			
1952	Jan	4671						
	Feb	5057						
	Mar	4439						
	Apr	3946						
	May	4324						
	June	5016						
	July	3170						
	Aug	4437						
	Sept	4743						
	Oct	4651						
	Nov	4646						
	Dec	4497						

.0439) 254.07 (5791
2195
3659

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

K-919

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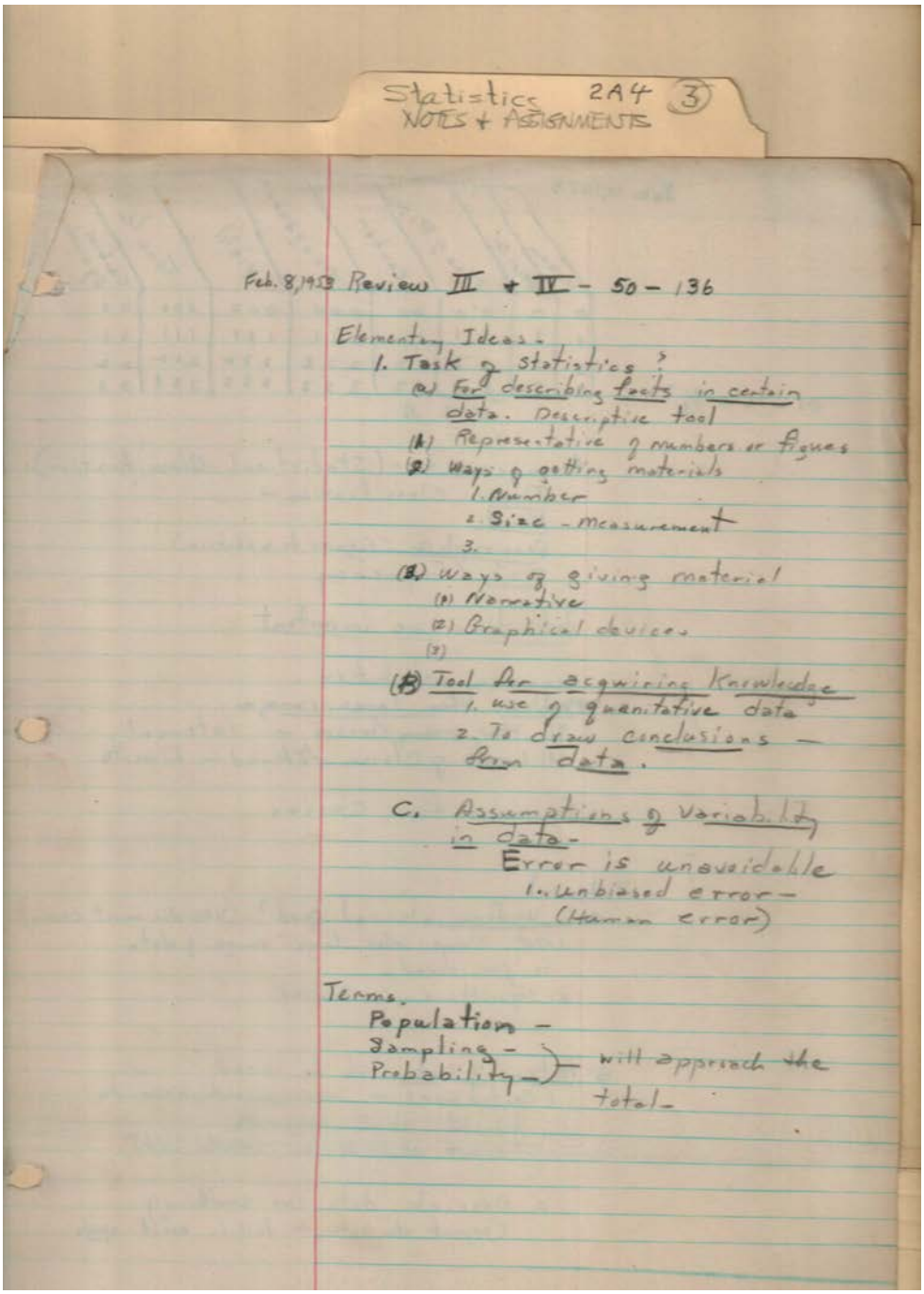
3. Prepare graphs of the index numbers prepared in (1) and (2) above.

129.3
.043
11677
3879
5172
5.674 27

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Feb. 8, 1952 Review III + IV - 50 - 136

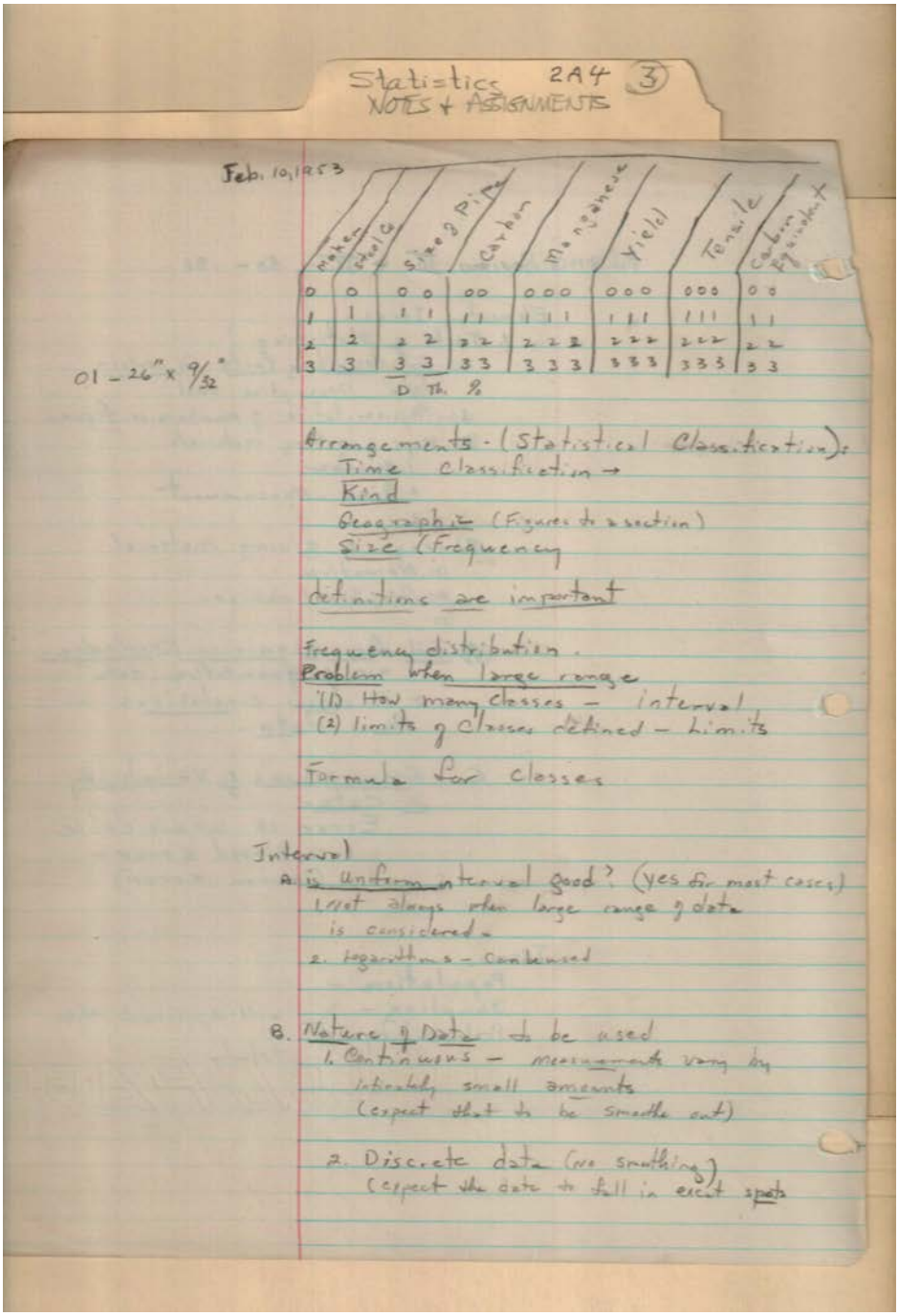
Elementary Ideas.
1. Task of statistics?
(a) For describing facts in certain data. Descriptive tool
(b) Representative of numbers or figures
(2) Ways of getting materials
1. Number
2. Size - measurement
3.
(3) Ways of giving material
(1) Narrative
(2) Graphical devices.
(3)
(B) Tool for acquiring knowledge
1. use of quantitative data
2. To draw conclusions - from data.

C. Assumptions of Variability in data.
Error is unavoidable
1. unbiased error - (Human error)

Terms.
Population -
Sampling -
Probability - } will approach the total.

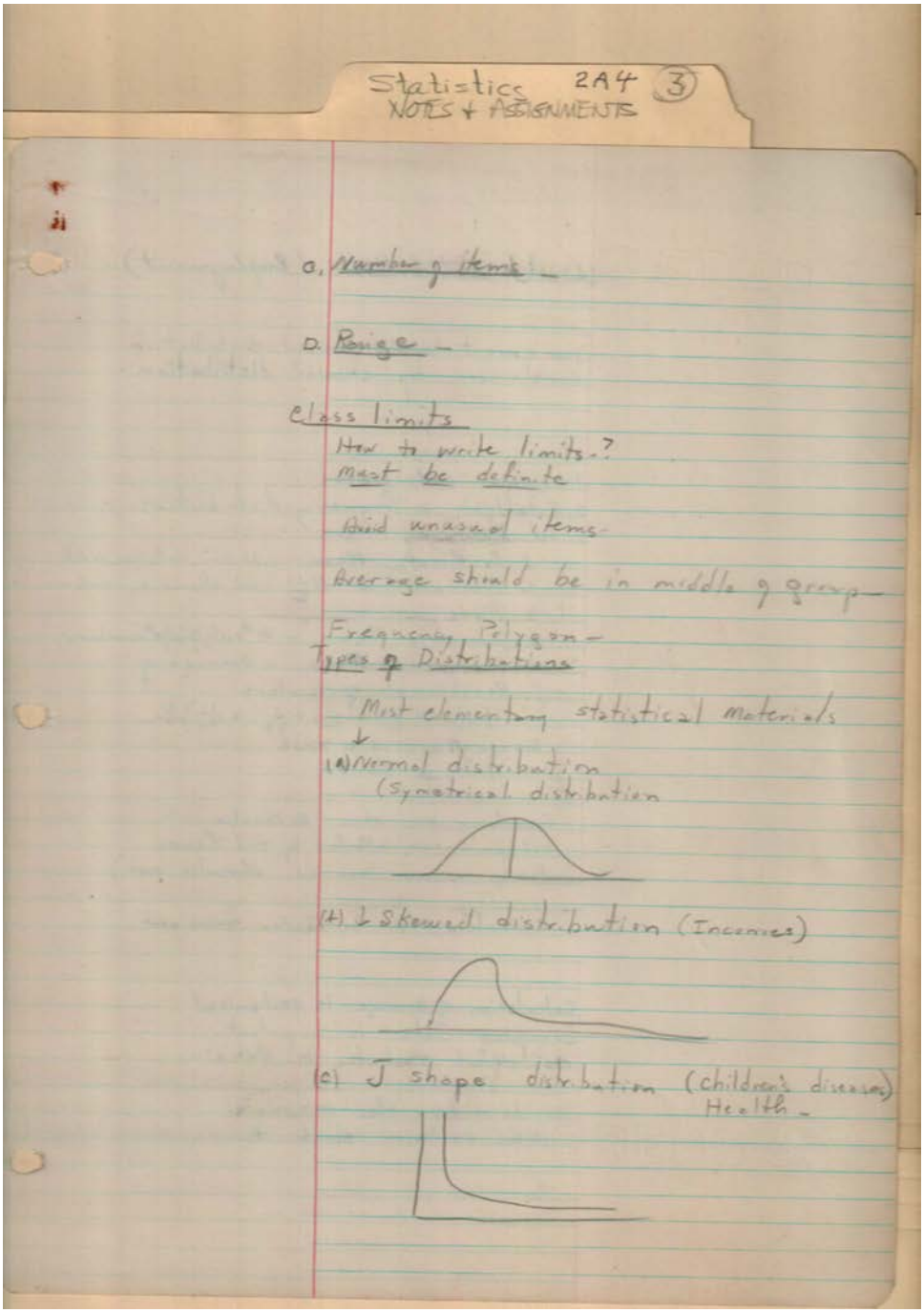
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



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Statistical Notes

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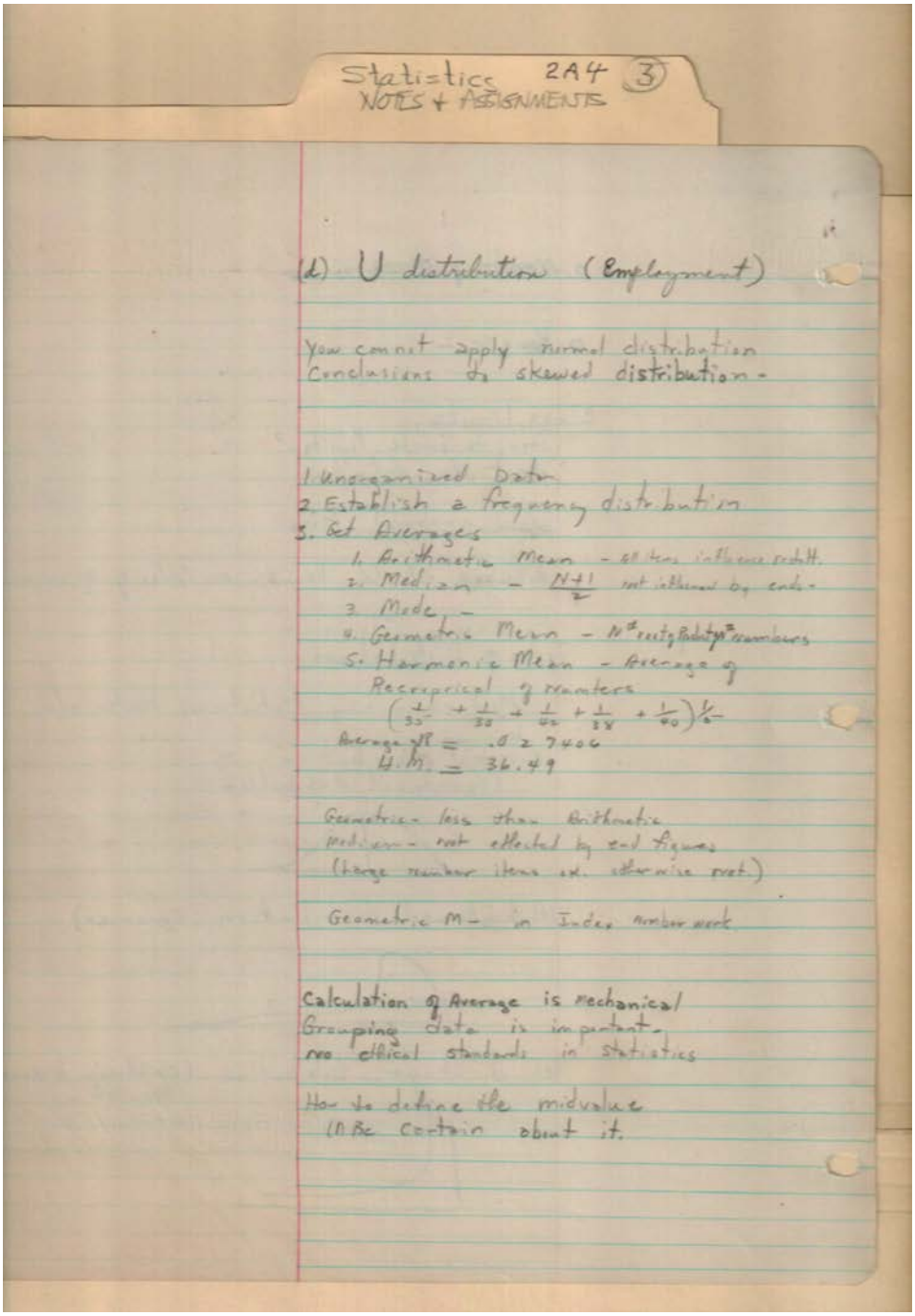

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Types:
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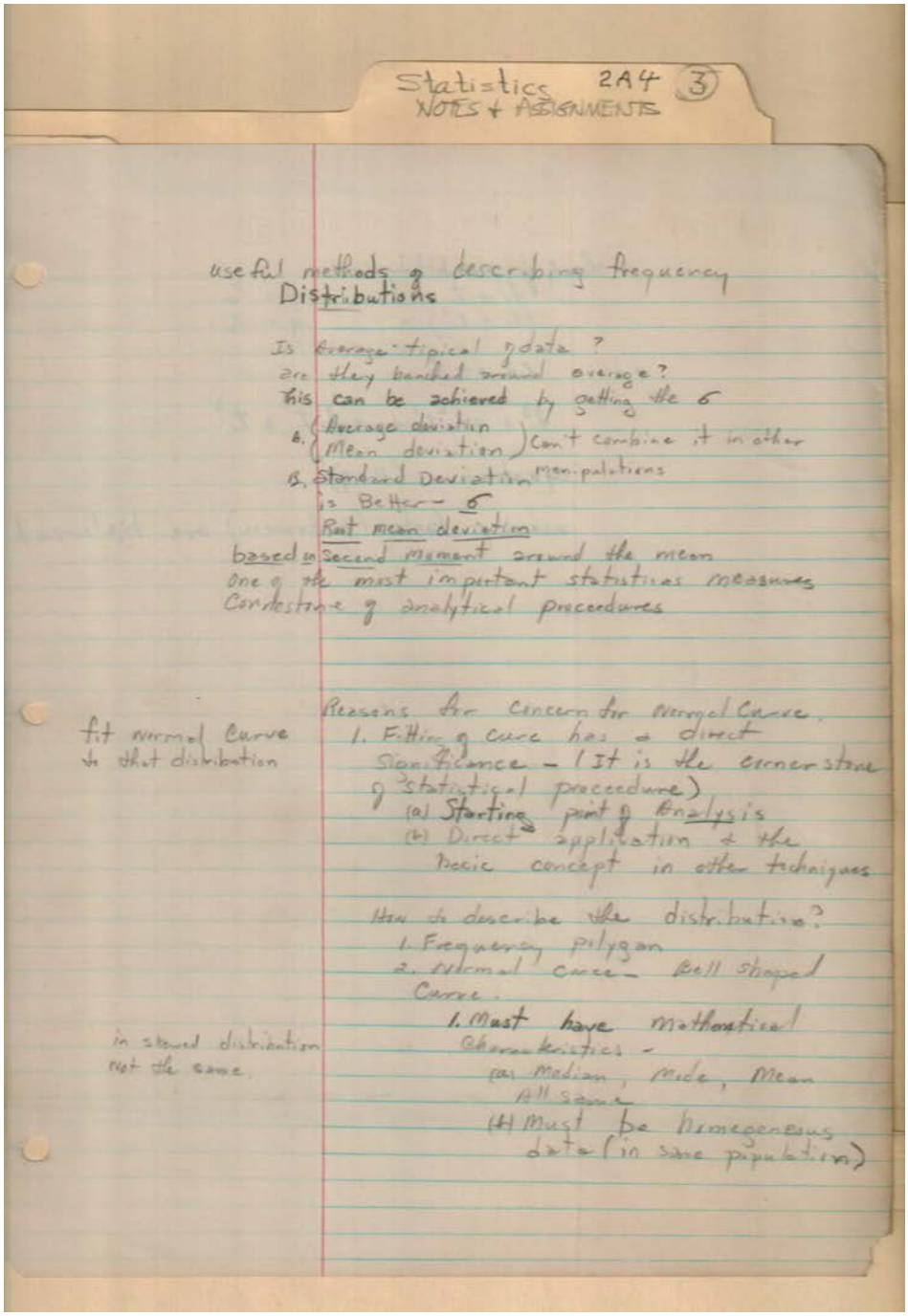

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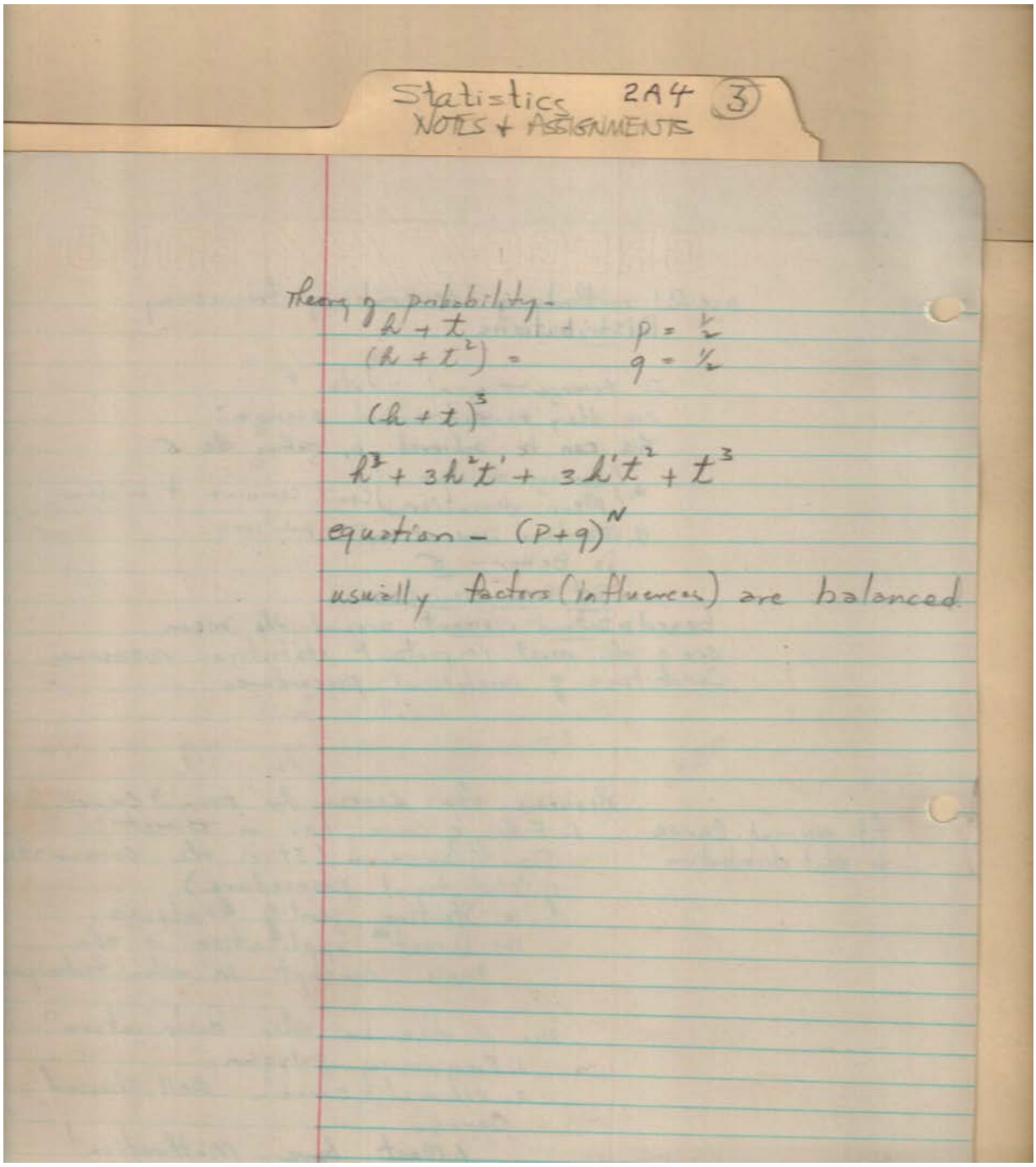
Statistical Notes

Types:
notes



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Statistical Notes

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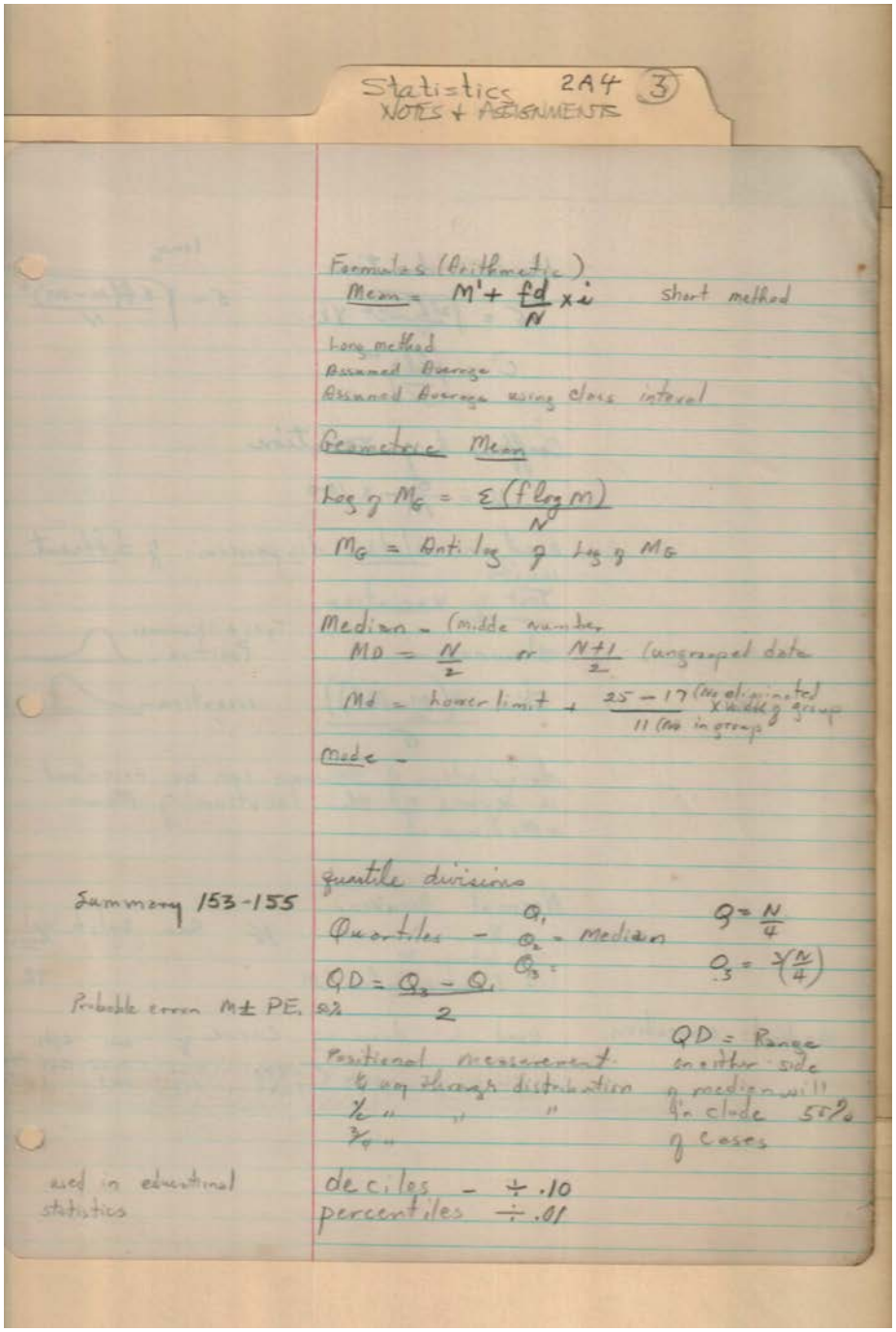

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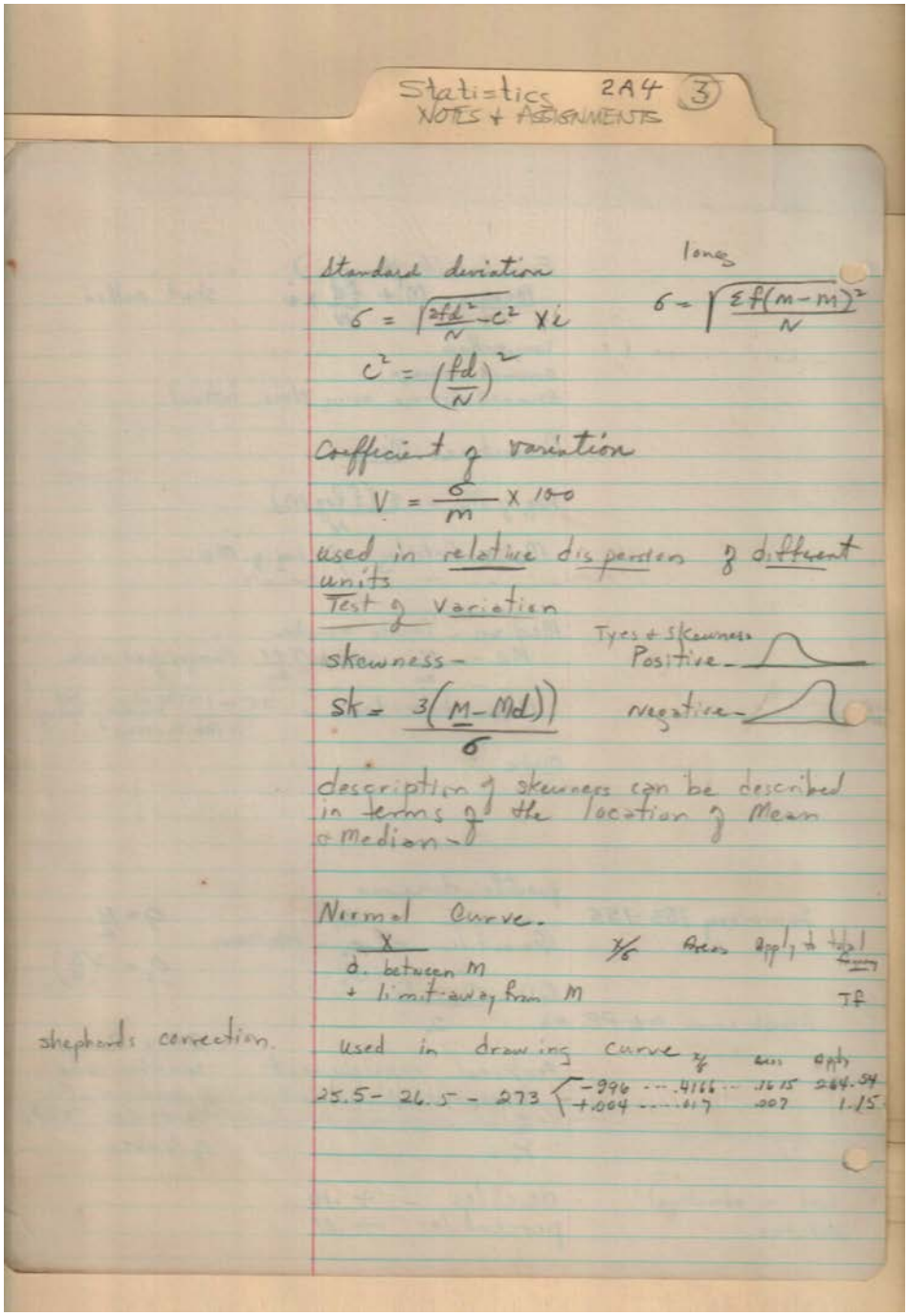
notes



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Statistical Notes

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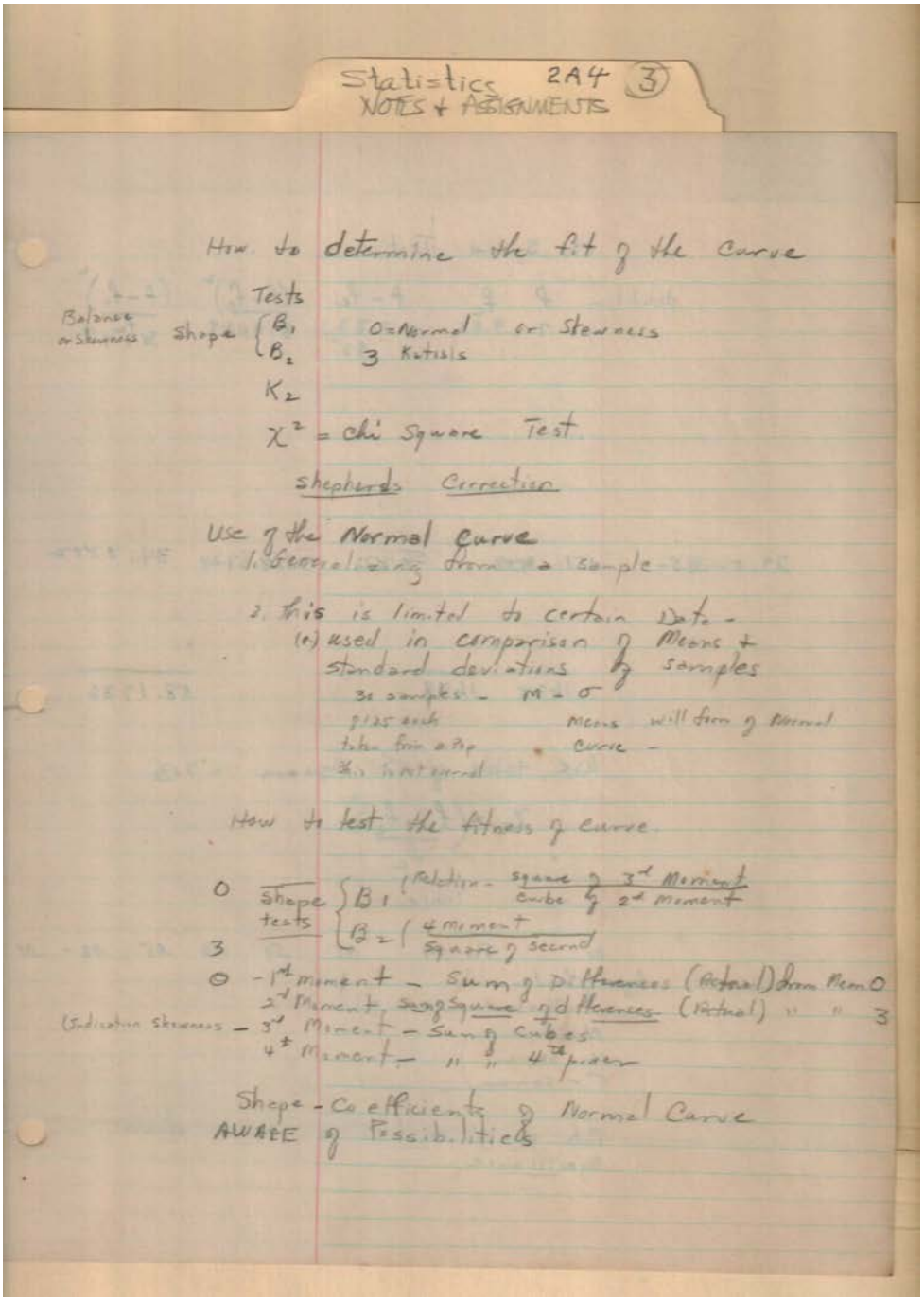
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

How to determine the fit of the Curve

Tests

Balance or skewness — Shape { B_1 0=Normal or Skewness
B_2 3 Kurtosis

K_2

χ^2 = chi Square Test

Sheppards Correction

Use of the Normal Curve

1. Generalizing from a sample

2. This is limited to certain Data -
(a) used in comparison of Means & Standard deviations of samples
31 samples - M + σ
of 25 each Means will form a Normal
taken from a Pop. Curve -
$\bar{x}$ is not normal

How to test the fitness of curve

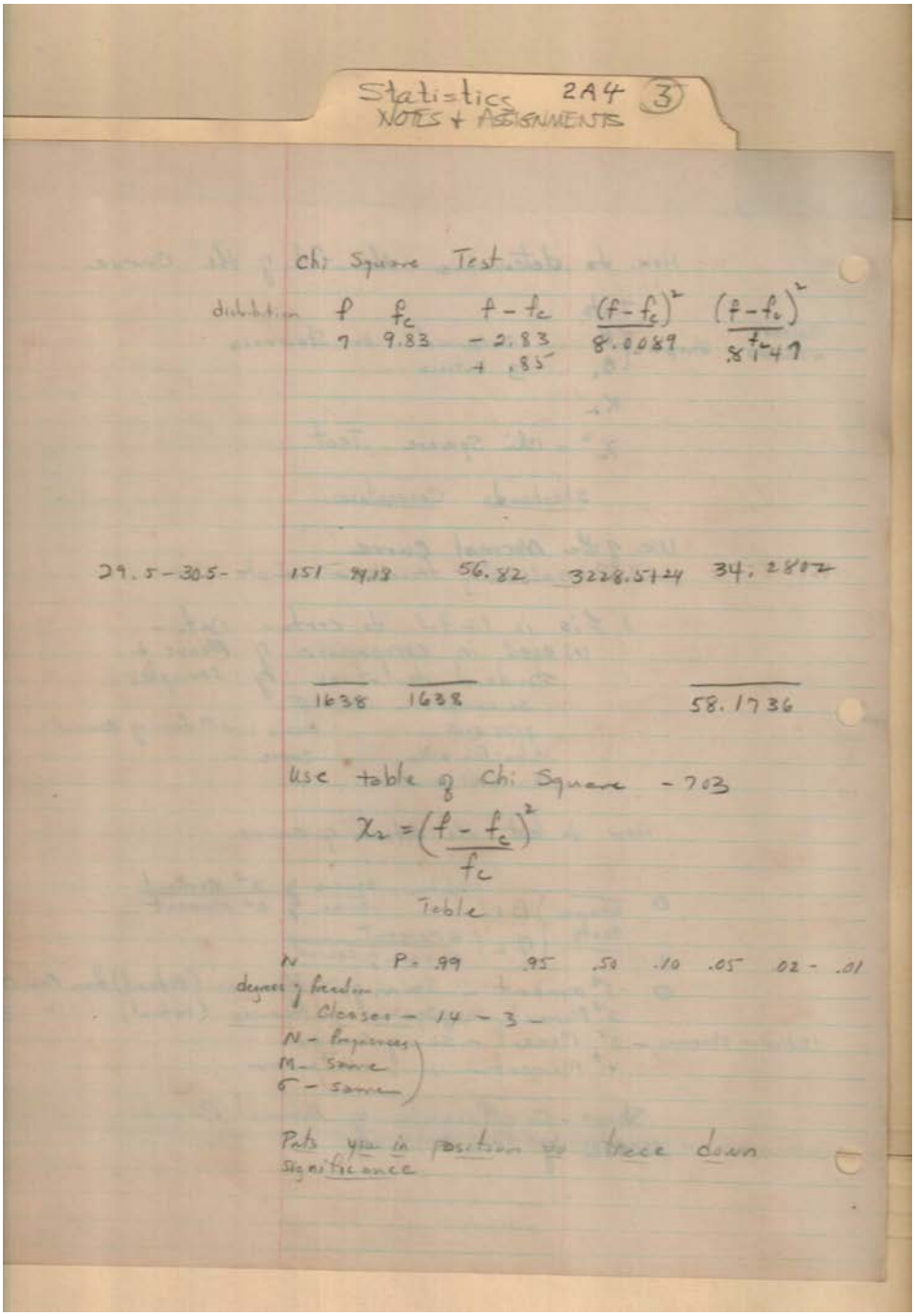
0 Shape tests { B_1 (Relation - square of 3rd Moment / cube of 2nd moment
3 { B_2 (4 Moment / Square of second

0 - 1st moment - Sum of Differences (Actual) from Mean 0
2nd Moment, sum Square of differences (Actual) " " 3
(Indication skewness - 3rd Moment - Sum of Cubes
4th Moment - " " 4th power

Shape - Coefficients of Normal Curve
AWARE of Possibilities

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Chi Square Test

distribution	f	f_e	$f - f_e$	$(f-f_e)^2$	$\frac{(f-f_e)^2}{f_e}$
	7	9.83	−2.83	8.0089	.8147
			+.85		
29.5–30.5	151	94.18	56.82	3228.5424	34.2802
	1638	1638			58.1736

use table of Chi Square -703

$$\chi_2 = \frac{(f - f_e)^2}{f_e}$$

Table

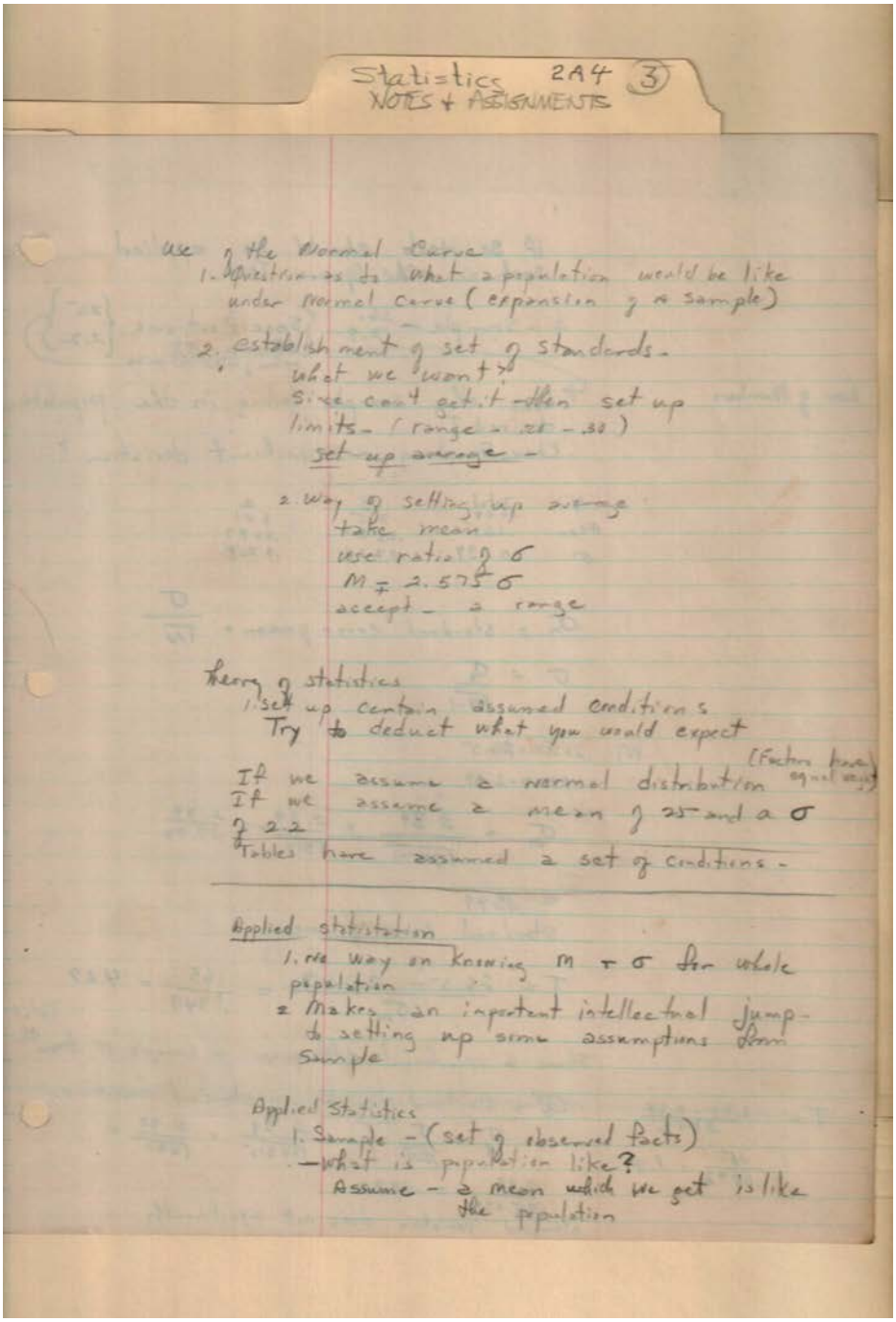
N	P = .99	.95	.50	.10	.05	.02	.01
degrees of freedom							
Classes – 14 – 3 –							

N – frequency
M – Same
S – Same

Puts you in position to trace down Significance

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Use of the Normal Curve
1. Investigation as to what a population would be like under normal curve (expansion of a sample)

2. establishment of set of standards.
what we want?
Since can't get it - then set up limits - (range - .2σ - .3σ)
set up average -

2. Way of setting up average
take mean
use ratio of σ
M ± 2.575 σ
accept - a range

Theory of statistics
1. set up certain assumed conditions
Try to deduct what you would expect

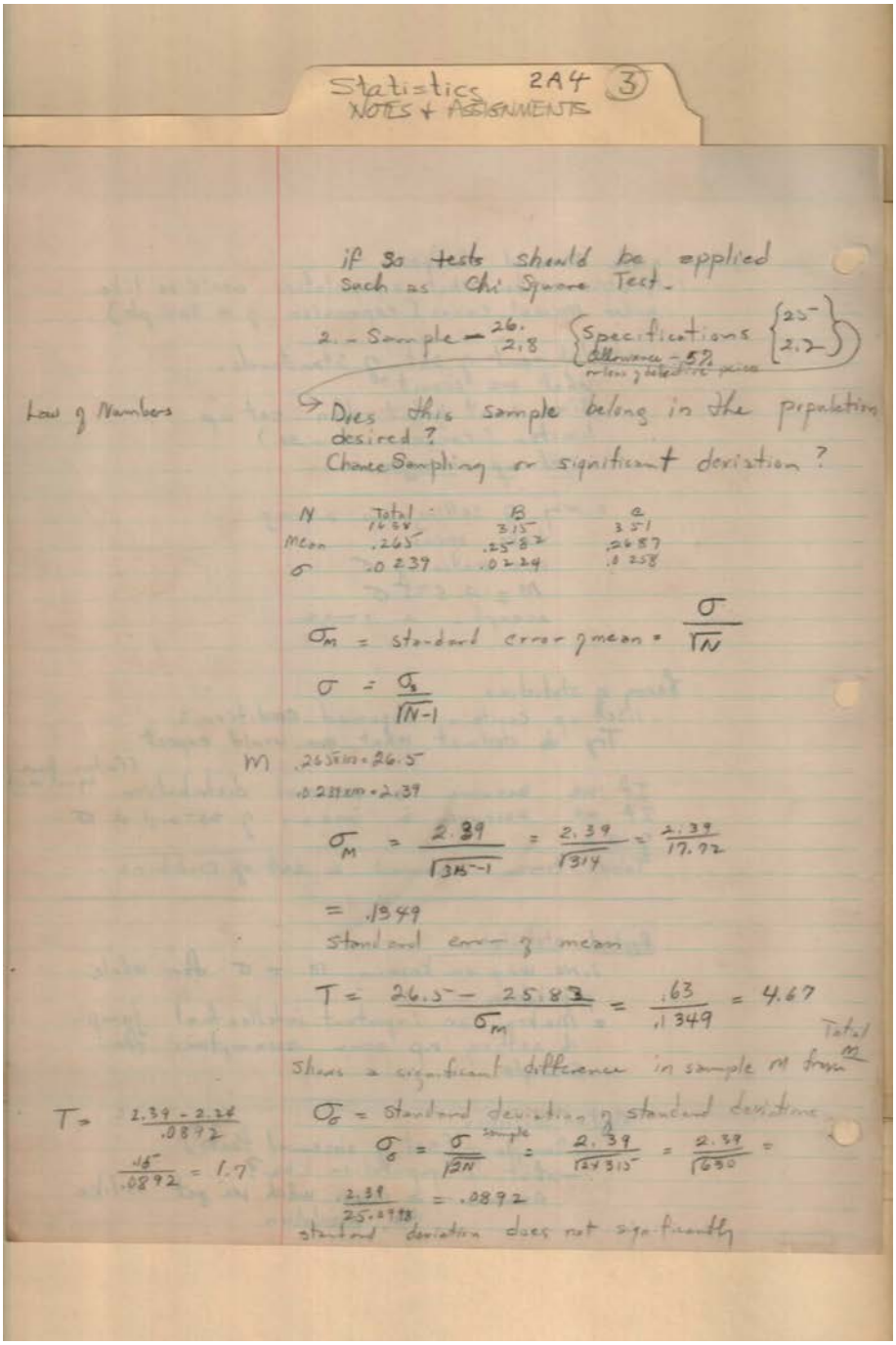
If we assume a normal distribution (Factors have equal weight)
If we assume a mean of 25 and a σ of 2.2
Tables have assumed a set of conditions -

Applied statistics
1. no way on knowing M + σ for whole population
2. Makes an important intellectual jump - to setting up some assumptions from sample

Applied Statistics
1. Sample - (set of observed facts)
- what is population like?
Assume - a mean which we get is like the population

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

if so tests should be applied such as Chi Square Test.

2 - Sample — 26. / 2.18 {Specifications 25⁻ / 2.2⁻} difference = .5? minus; absolute price

Law of Numbers

→ Does this sample belong in the population desired?
Chance Sampling or significant deviation?

	N	Total	B	C
		1484	315⁻	351
	Mean	.265⁻	.2582	.2687
	σ	.0239	.0224	.0258

σ_M = standard error of mean = $\frac{\sigma}{\sqrt{N}}$

$\sigma = \frac{\sigma_s}{\sqrt{N-1}}$

M .265 in = 26.5⁻
.0239 in = 2.39

$\sigma_M = \frac{2.39}{\sqrt{315-1}} = \frac{2.39}{\sqrt{314}} = \frac{2.39}{17.72}$

= .1349
standard error of mean

$T = \frac{26.5^- - 25.83}{\sigma_M} = \frac{.63}{.1349} = 4.67$

Total M shows a significant difference in sample M from

$T = \frac{2.39 - 2.28}{.0892}$ $\frac{.15^-}{.0892} = 1.7$

σ_σ = standard deviation of standard deviations

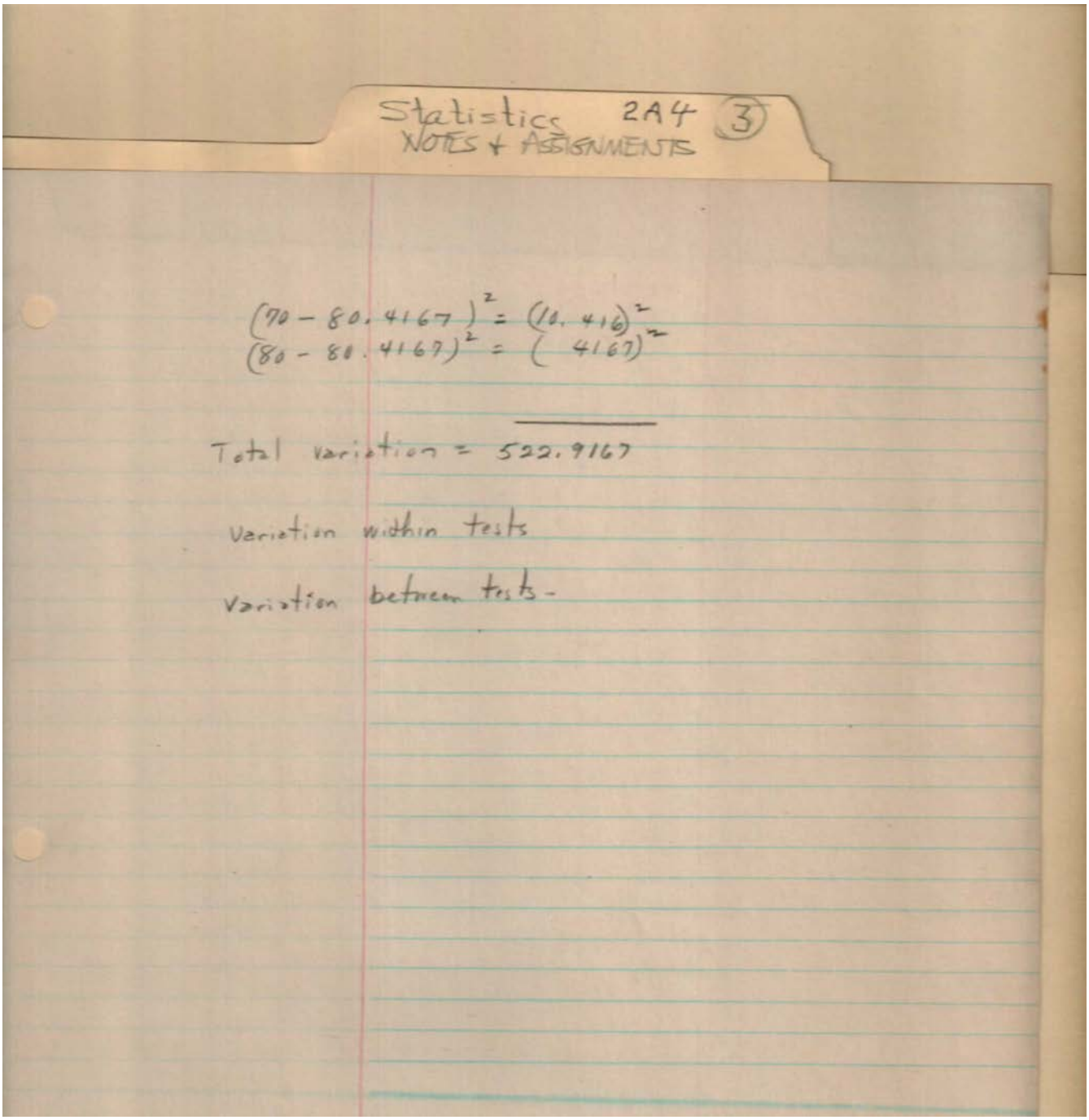
$\sigma_\sigma = \frac{\sigma}{\sqrt{2N}} = \frac{2.39}{\sqrt{2 \times 315^-}} = \frac{2.39}{\sqrt{630}} =$

$\frac{2.39}{25.0998} = .0892$

standard deviation does not significantly

Names:
Statistical Notes

Types:
notes



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Statistical Notes

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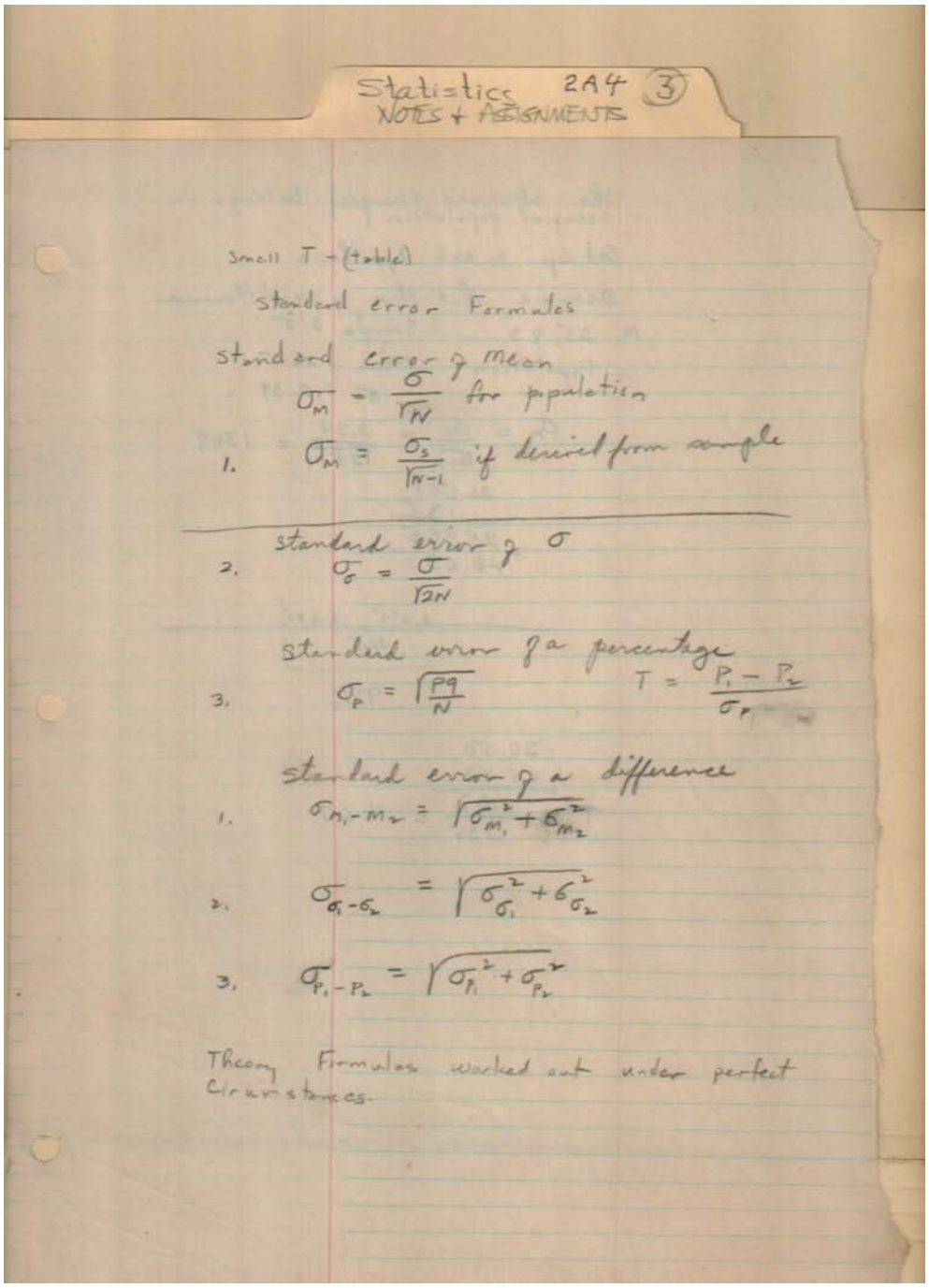


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Small T + (table)

Standard error Formulas

Standard error of mean

$\sigma_M = \frac{\sigma}{\sqrt{N}}$ for population

1. $\sigma_M = \frac{\sigma_s}{\sqrt{N-1}}$ if derived from sample

Standard error of σ

2. $\sigma_\sigma = \frac{\sigma}{\sqrt{2N}}$

Standard error of a percentage

3. $\sigma_p = \sqrt{\frac{pq}{N}}$ $T = \frac{P_1 - P_2}{\sigma_p}$

Standard error of a difference

1. $\sigma_{M_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$

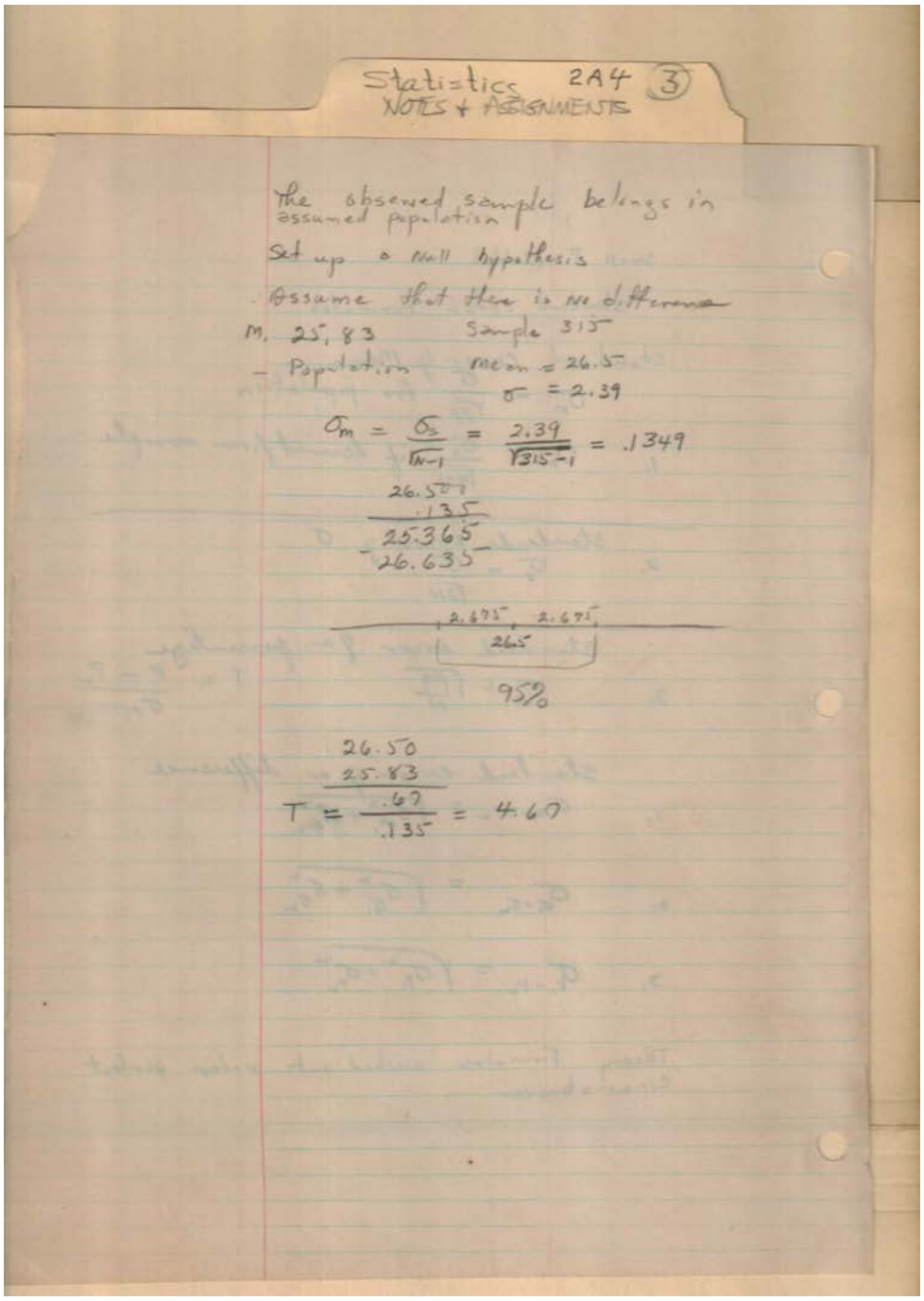
2. $\sigma_{\sigma_1 - \sigma_2} = \sqrt{\sigma_{\sigma_1}^2 + \sigma_{\sigma_2}^2}$

3. $\sigma_{P_1 - P_2} = \sqrt{\sigma_{P_1}^2 + \sigma_{P_2}^2}$

Theory Formulas worked out under perfect circumstances.

Names:
Statistical Notes

Types:
notes



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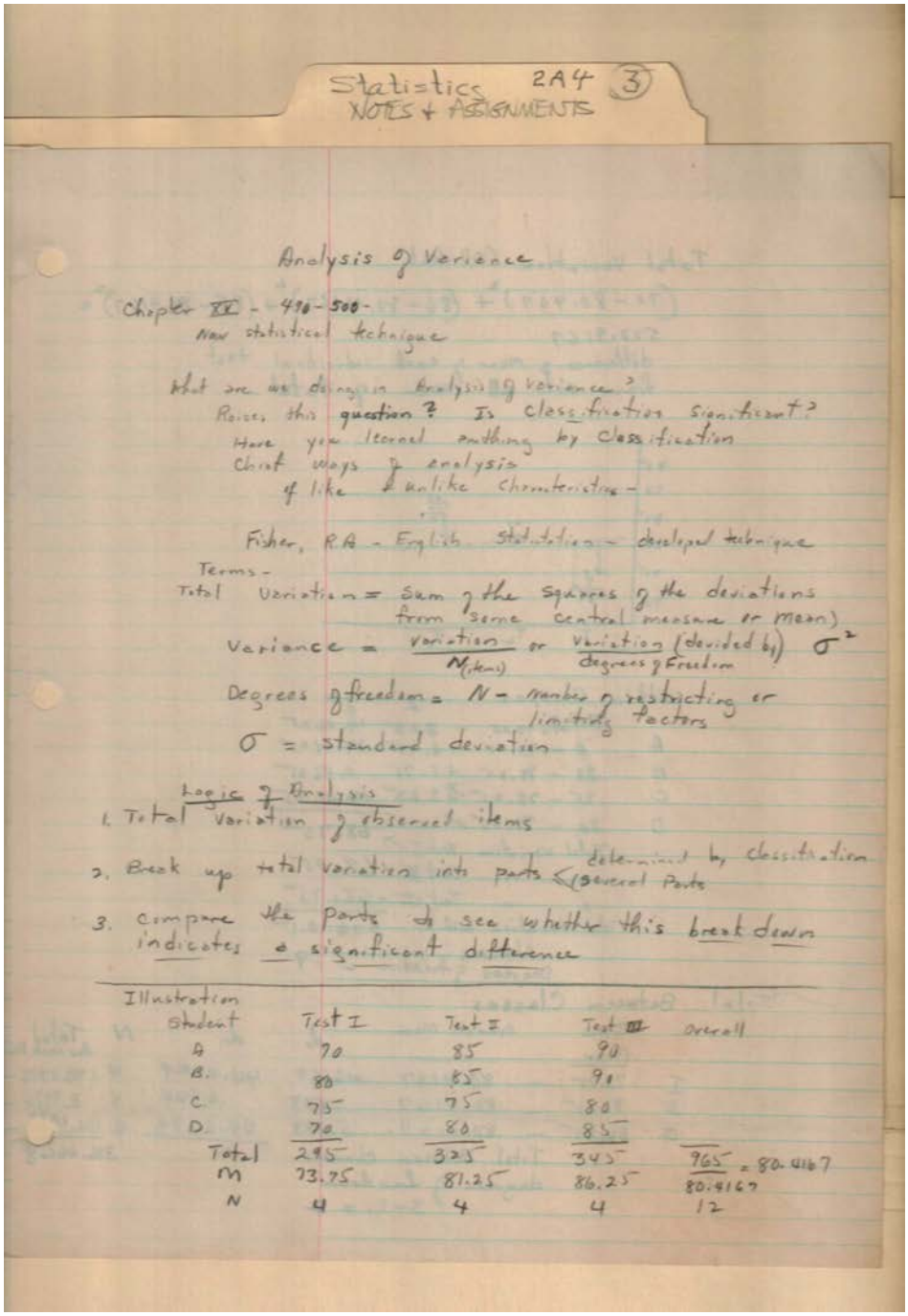


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Analysis of Variance

Chapter XI - 490-500-
New statistical technique

What are we doing in Analysis of Variance?
Raises this question? Is classification significant?
Have you learned anything by classification
Chief ways of analysis
of like & unlike characteristics -

Fisher, R.A. - English statistician - developed technique

Terms -
Total Variation = sum of the squares of the deviations from some central measure or mean)
Variance = $\frac{\text{variation}}{N(\text{items})}$ or $\frac{\text{variation (divided by)}}{\text{degrees of Freedom}}$ σ^2
Degrees of freedom = N - number of restricting or limiting factors
σ = standard deviation

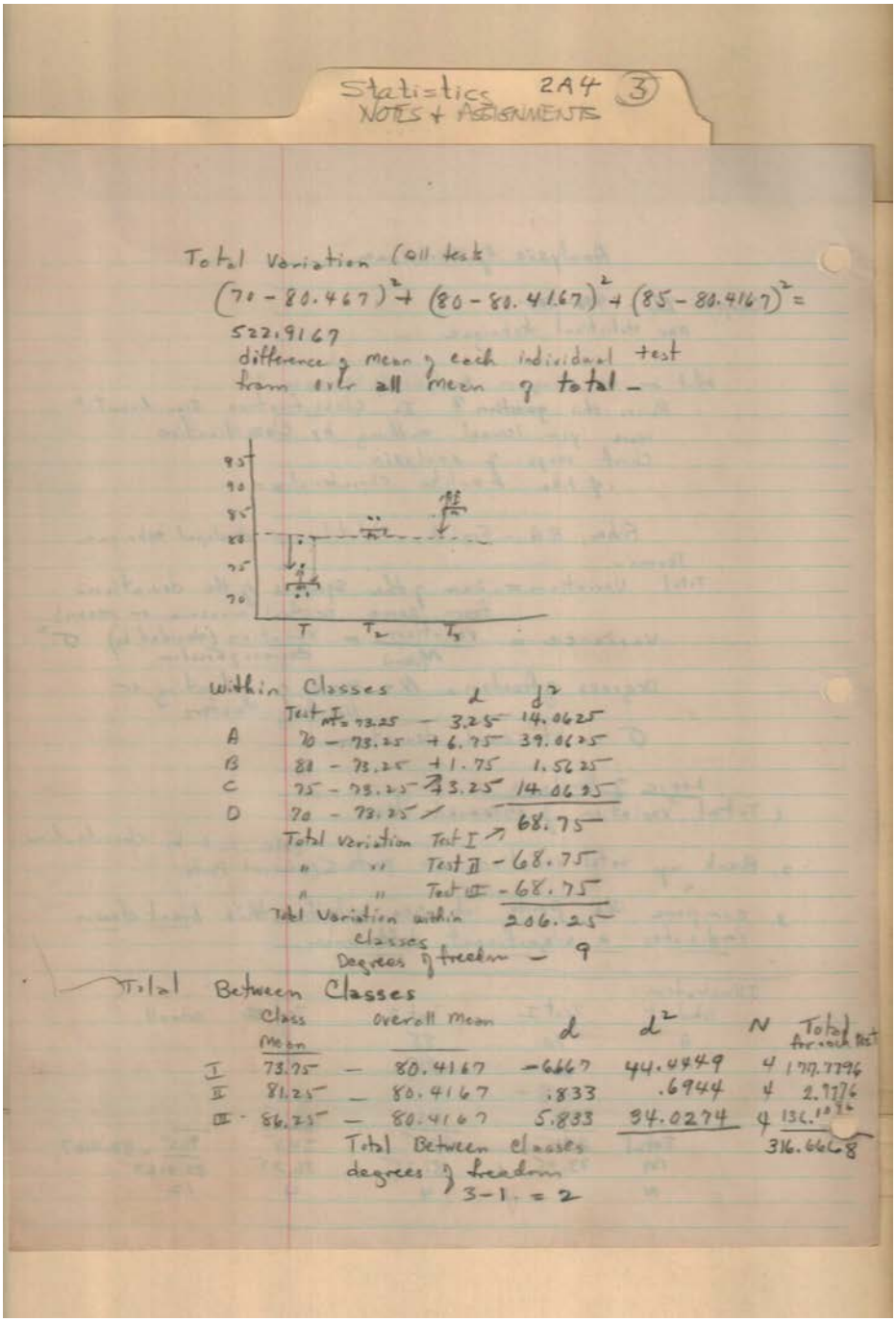
Logic of Analysis
1. Total variation of observed items
2. Break up total variation into parts determined by classification (several Parts)
3. Compare the parts to see whether this break down indicates a significant difference

Illustration

Student	Test I	Test II	Test III	Overall
A	70	85	90	
B.	80	85	91	
C.	75	75	80	
D.	70	80	85	
Total	295	325	345	965 = 80.4167
M	73.75	81.25	86.25	80.4167
N	4	4	4	12

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Total Variation (all tests)

$(70-80.4167)^2 + (80-80.4167)^2 + (85-80.4167)^2 =$

522.9167

difference of mean of each individual test from the all mean of total -

Within Classes

		d	d^2
Test I	73.25		
A	70 − 73.25	−3.25	14.0625
B	81 − 73.25	+6.75	39.0625
C	75 − 73.25	+1.75	1.5625
D	70 − 73.25	−3.25	14.0625
			68.75

Total variation Test I → 68.75
" " Test II → 68.75
" " Test III → 68.75
Total variation within classes 206.25
Degrees of freedom = 9

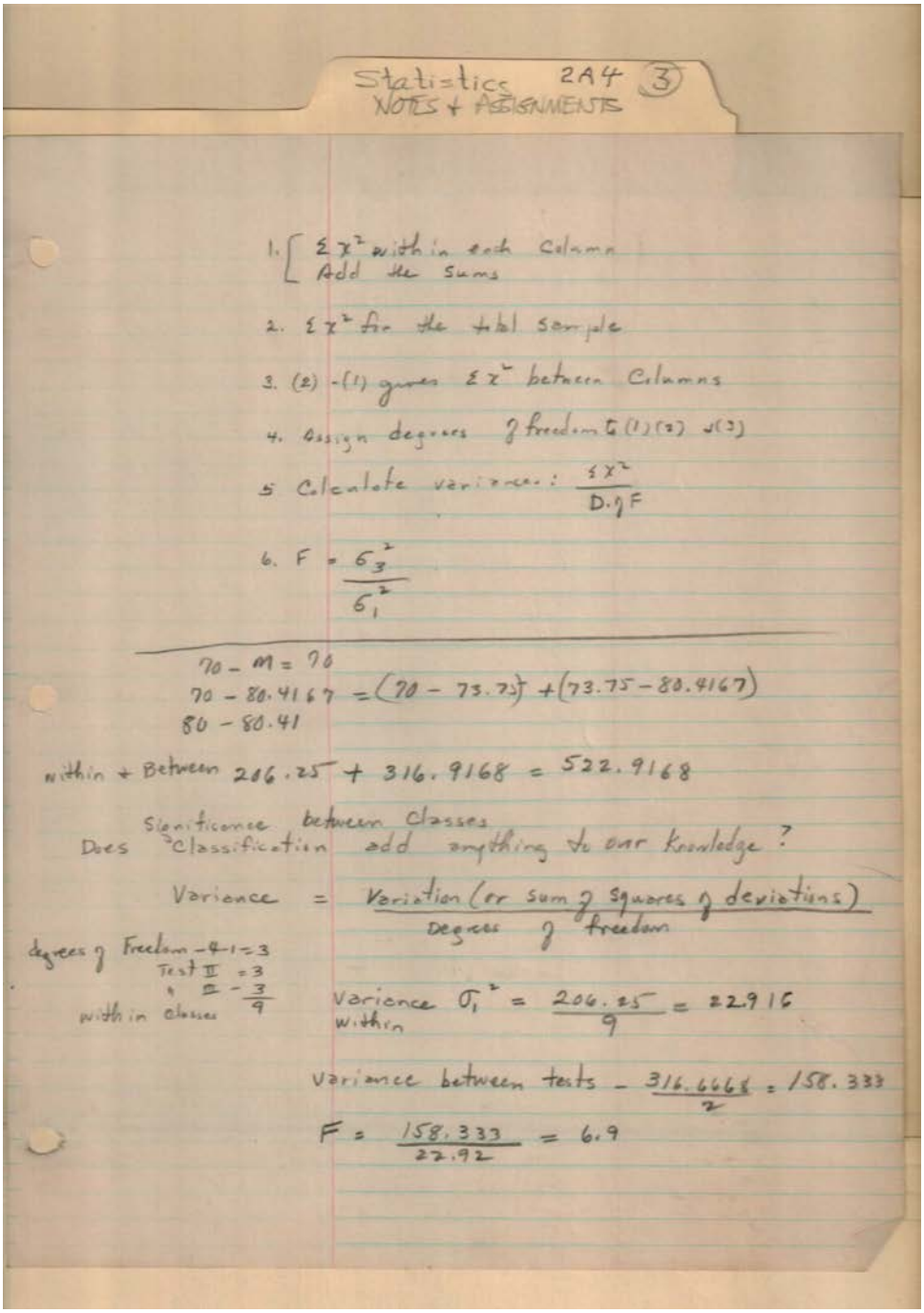
Total Between Classes

Class Mean		Overall Mean	d	d^2	N	Total for each test
I	73.25	− 80.4167	−6667	44.4449	4	177.7796
II	81.25	− 80.4167	.833	.6944	4	2.7776
III	86.25	− 80.4167	5.833	34.0274	4	136.1096
						316.6668

Total Between classes
degrees of freedom
3 − 1 = 2

Names:
Statistical Notes

Types:
notes



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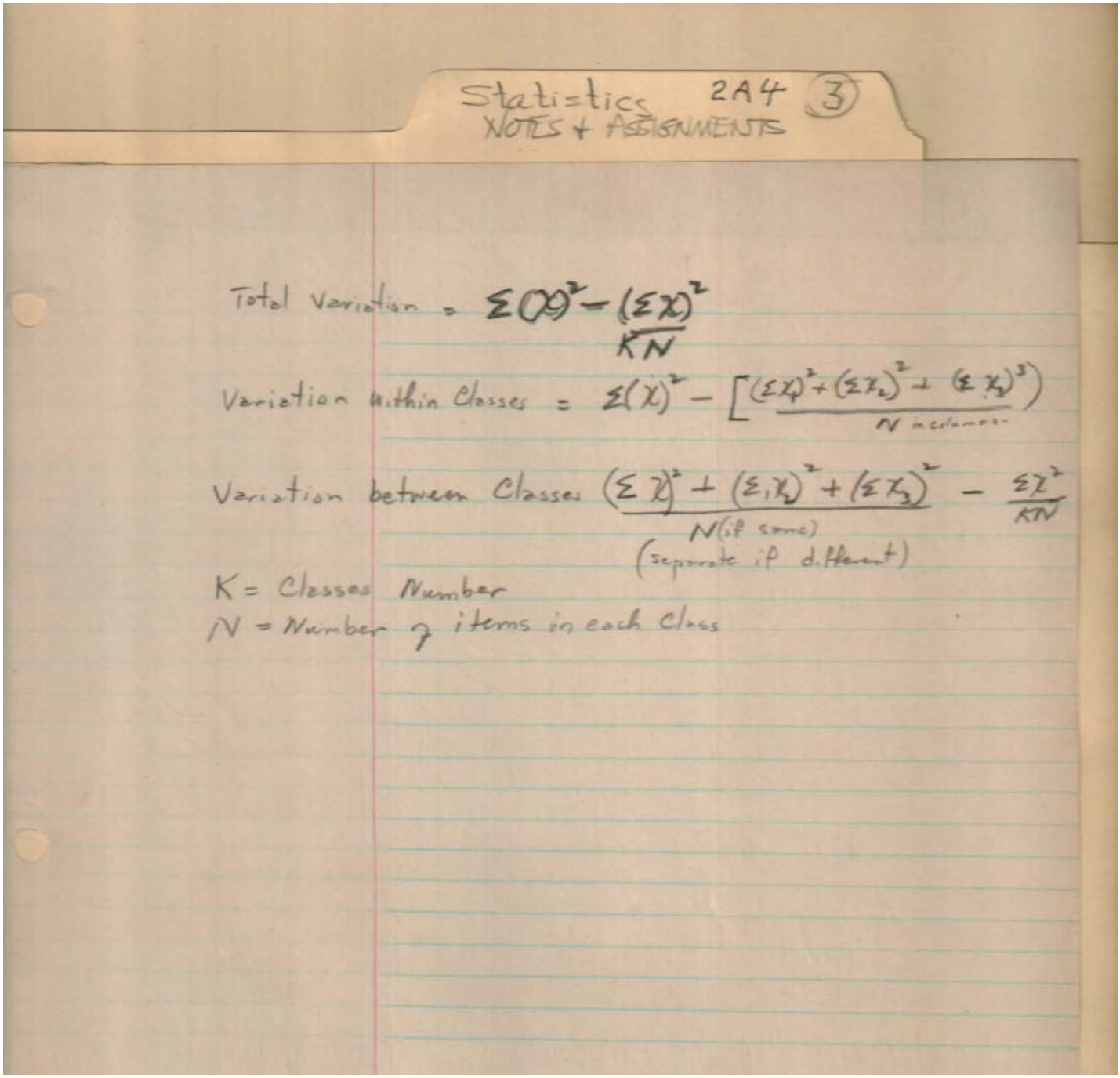

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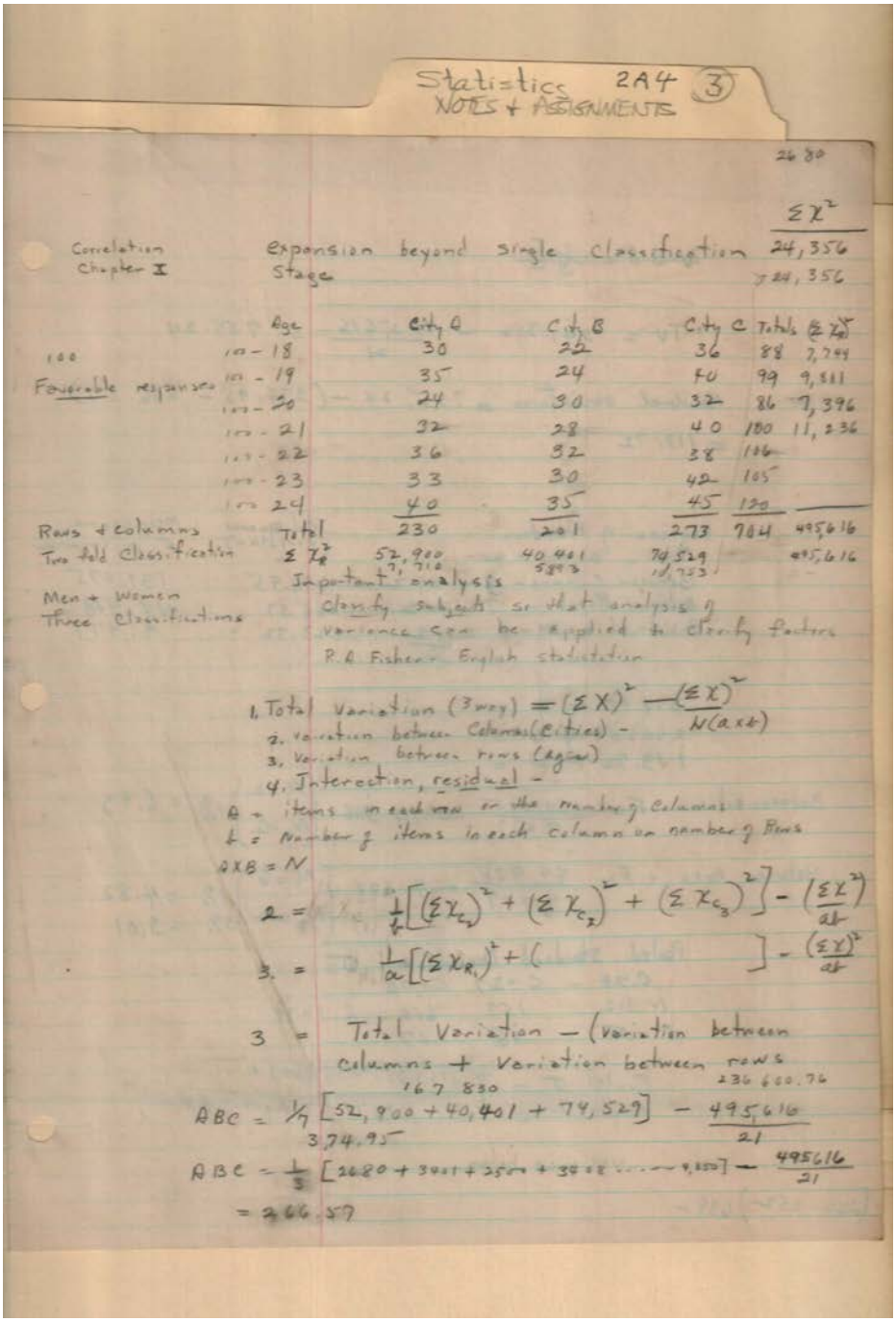


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

2680

ΣX^2 24,356

Correlation Chapter I — Expansion beyond single classification Stage

	Age	City A	City B	City C	Totals	ΣX_R^2
100	18	30	22	36	88	7,744
Favorable responses	19	35	24	40	99	9,801
	20	24	30	32	86	7,396
	21	32	28	40	100	11,236
	22	36	32	38	106	
	23	33	30	42	105	
	24	40	35	45	120	
Rows + columns Two fold classification	Total	230	201	273	704	495,616
	ΣX_R^2	52,900	40,401	74,529		495,616

Men + Women Three classifications

Important analysis classify subjects so that analysis of variance can be applied to classify factors
R.A. Fisher English statistician

1. Total Variation (3 way) $= (\Sigma X)^2 - \frac{(\Sigma X)^2}{N(a \times b)}$
2. variation between Columns (cities) -
3. Variation between rows (ages)
4. Interaction, residual -

a = items in each row or the number of columns
b = Number of items in each column or number of Rows
$a \times b = N$

2. $= \frac{1}{b}\left[(\Sigma X_{C_1})^2 + (\Sigma X_{C_2})^2 + (\Sigma X_{C_3})^2\right] - \frac{(\Sigma X)^2}{ab}$

3. $= \frac{1}{a}\left[(\Sigma X_{R_1})^2 + (\quad)\right] - \frac{(\Sigma X)^2}{ab}$

3 = Total Variation − (variation between columns + variation between rows

167 830 236 600.76

$ABC = \frac{1}{7}[52,900 + 40,401 + 74,529] - \frac{495,616}{21}$

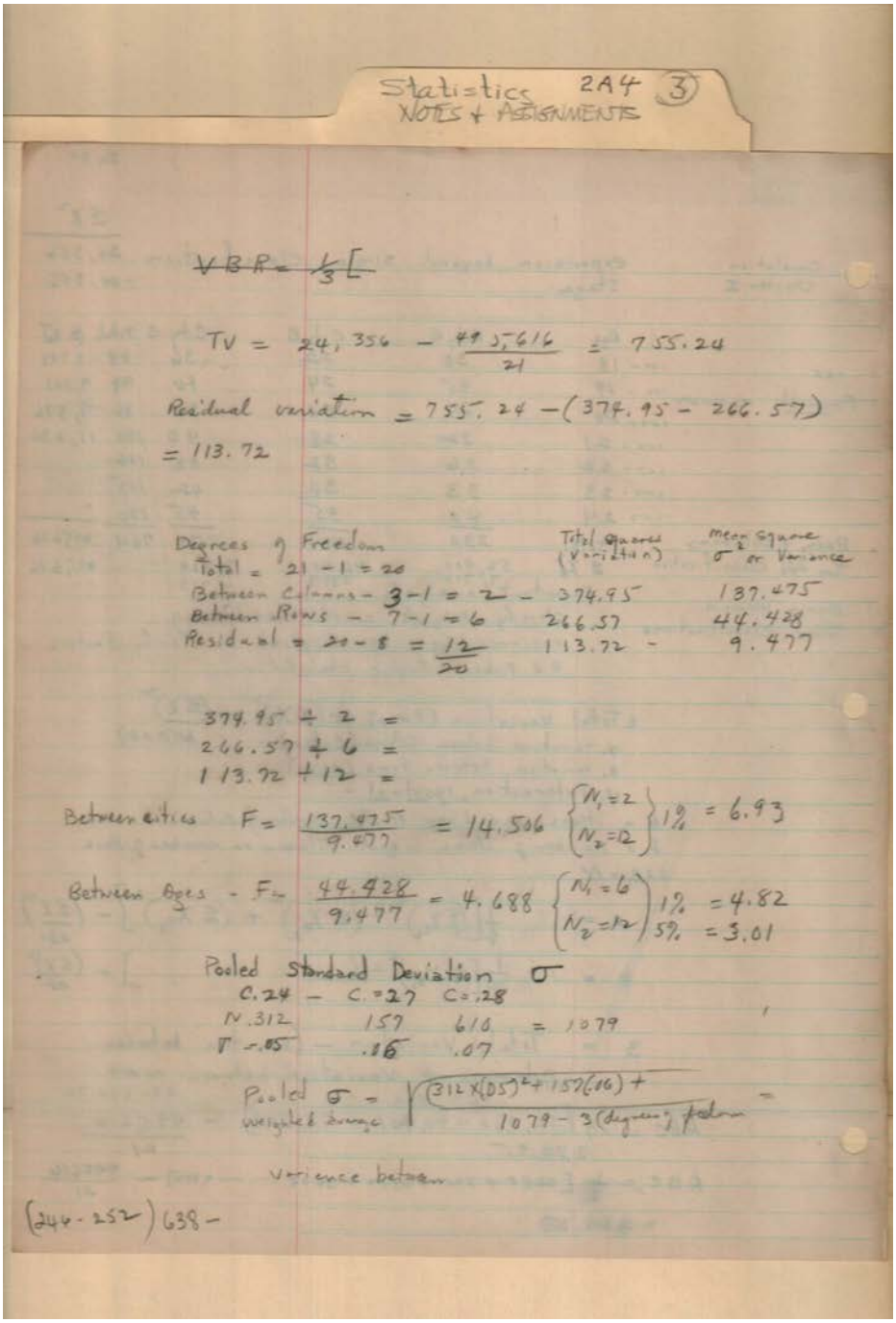
3,74.95

$ABC = \frac{1}{5}[2680 + 3001 + 2500 + 3008 \ldots\ldots 4,150] - \frac{495616}{21}$

$= 266.57$

Names:
Statistical Notes

Types:
notes



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Statistical Notes

Types:
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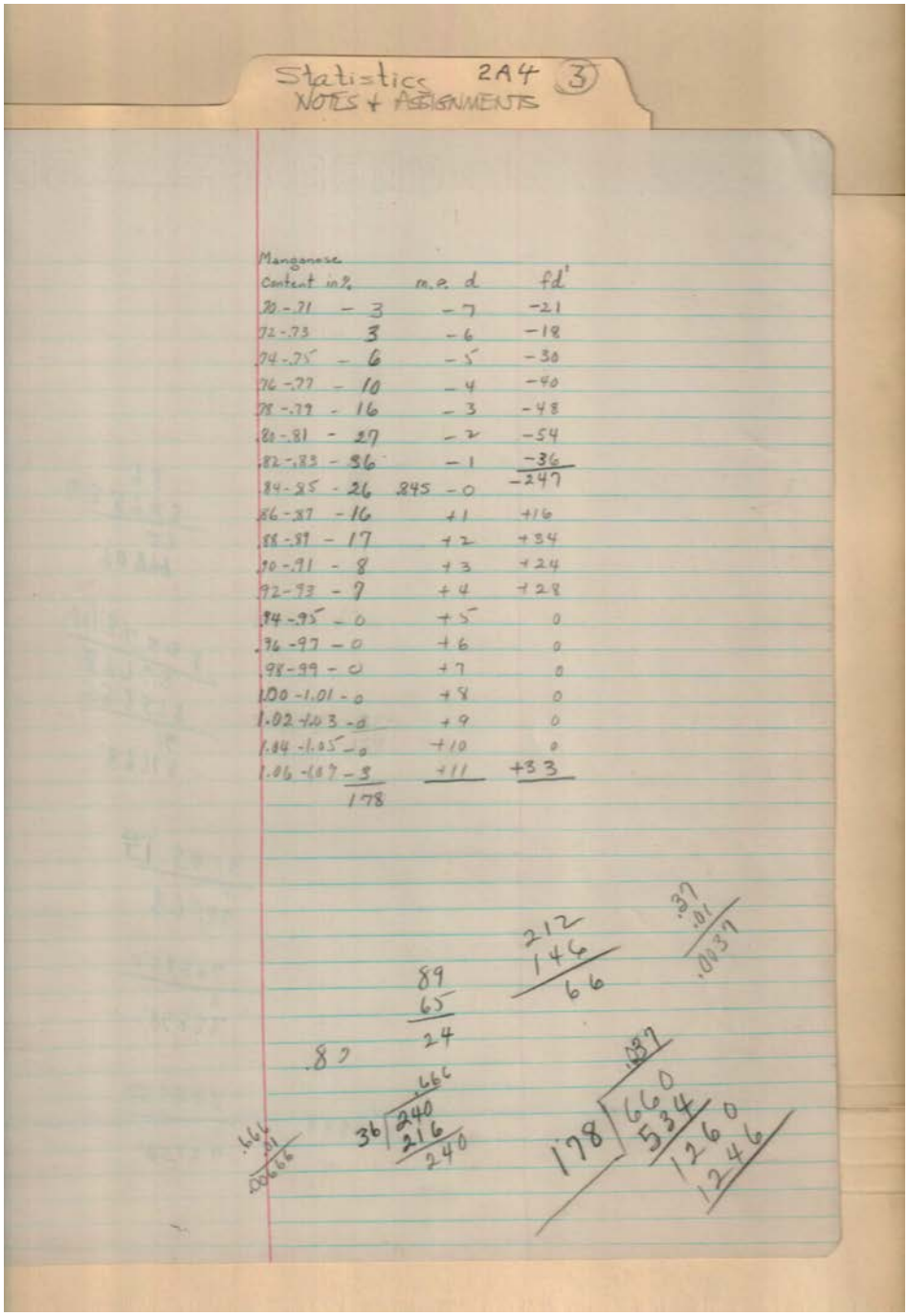

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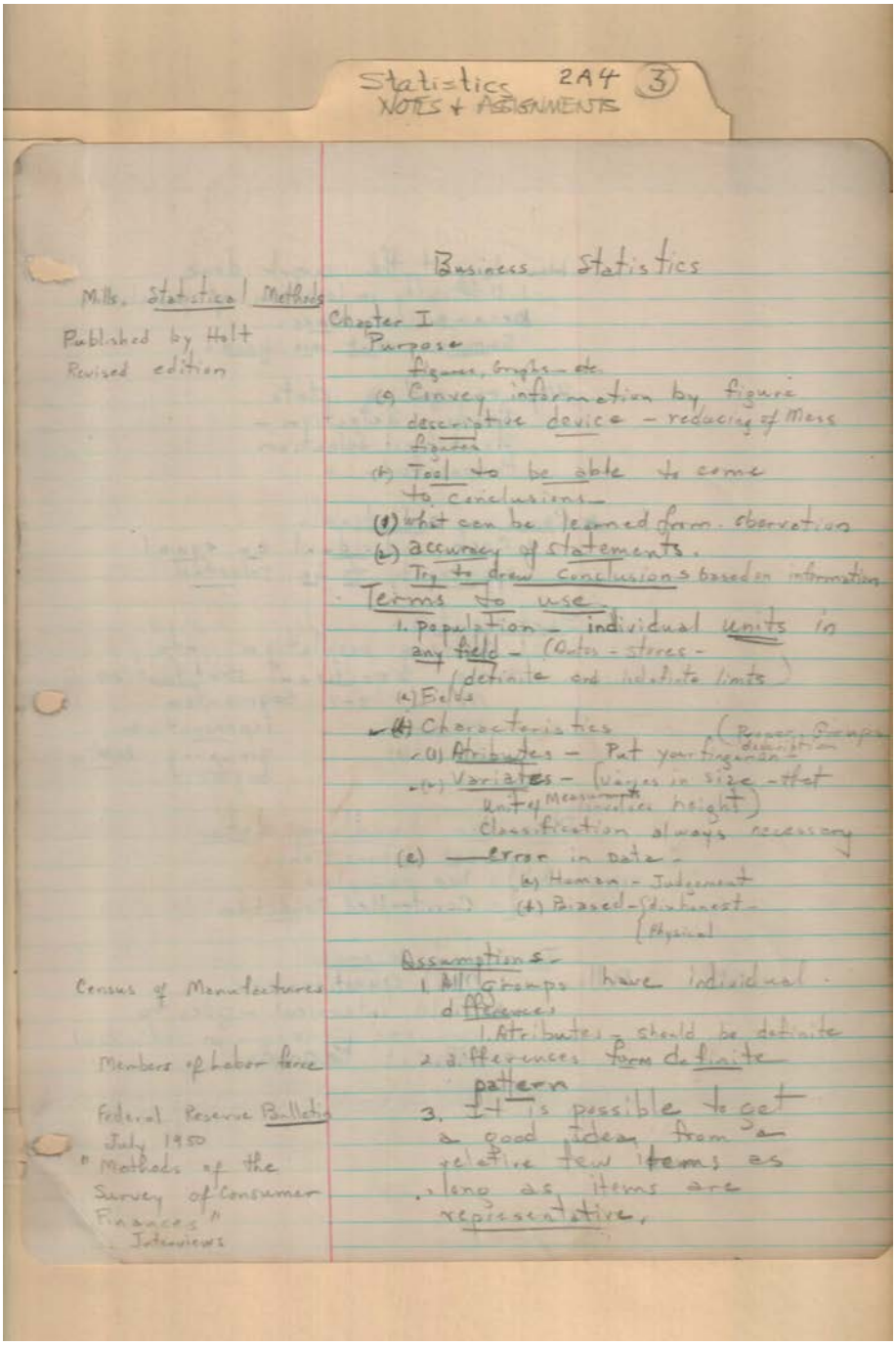

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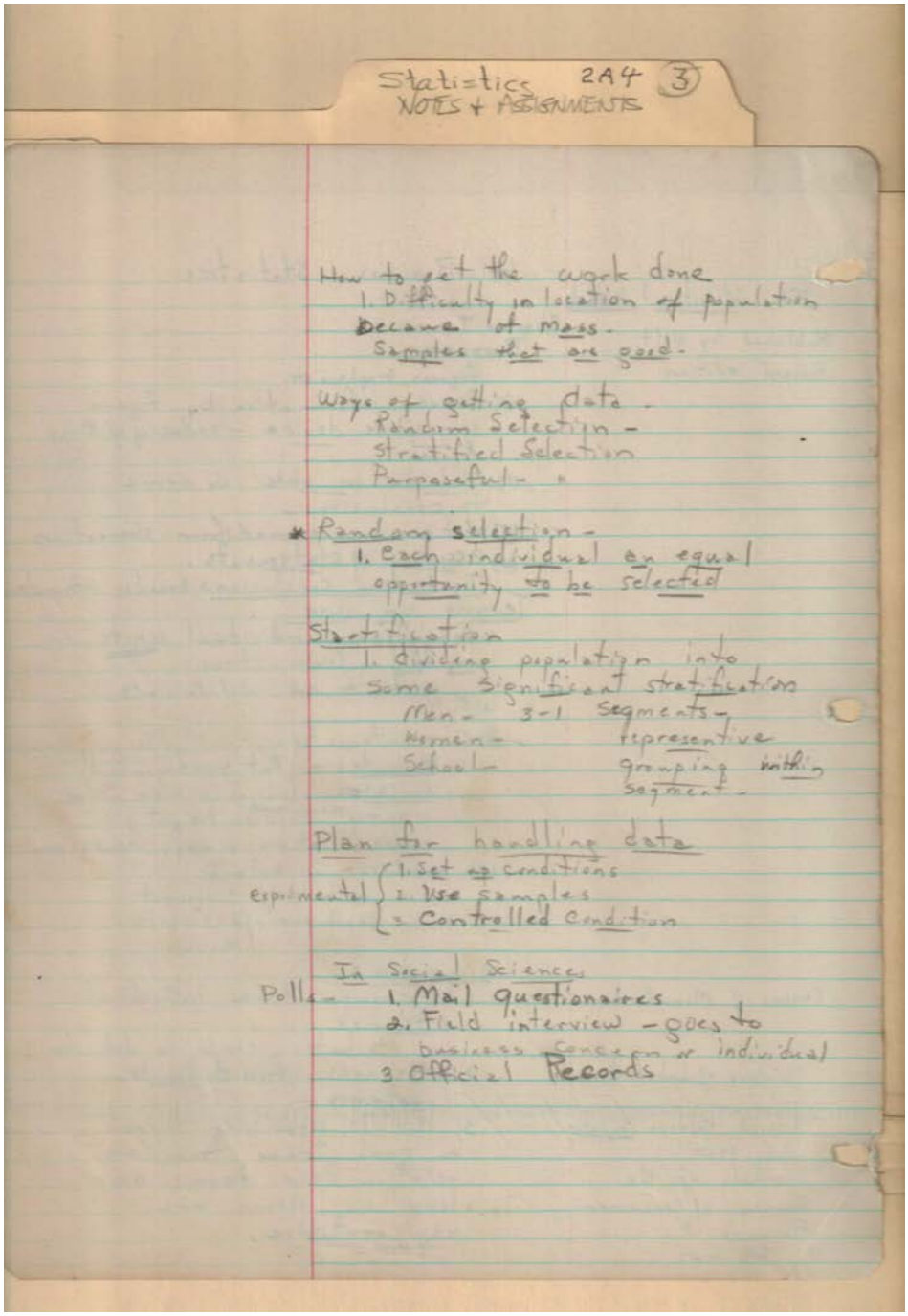

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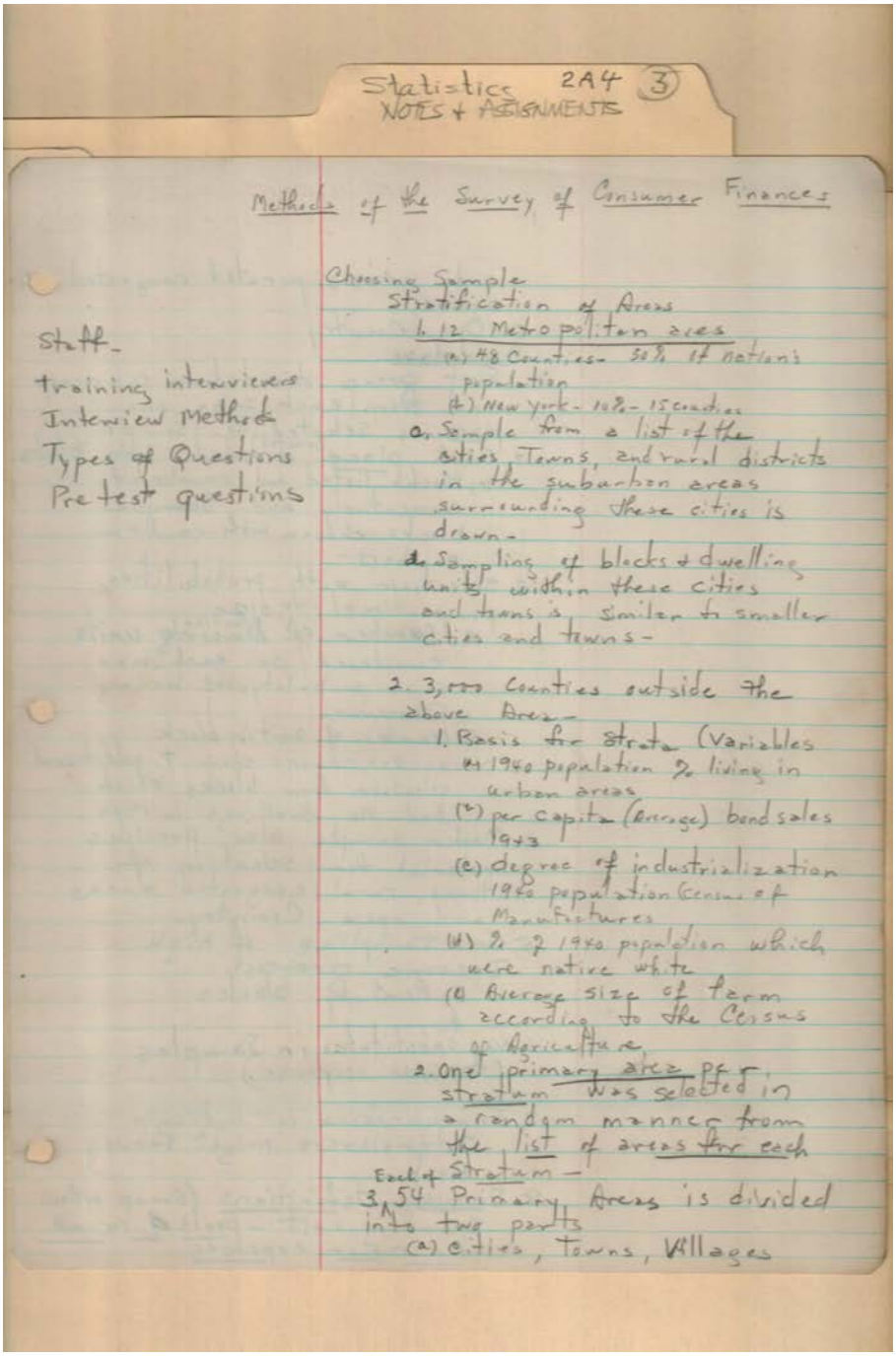

Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Methods of the Survey of Consumer Finances

Staff -
training interviewers
Interview Method
Types of Questions
Pretest questions

Choosing Sample
Stratification of Areas
1. 12 Metropolitan areas
(a) 48 Counties - 50% of nation's population
(b) New York - 10% - 15 counties
a. Sample from a list of the cities, Towns, and rural districts in the suburban areas surrounding these cities is drawn -
b. Sampling of blocks & dwelling units within these cities and towns is similar to smaller cities and towns -

2. 3,000 Counties outside the above Area -
1. Basis for strata (Variables
(a) 1940 population % living in urban areas
(b) per capita (average) bond sales 1933
(c) degree of industrialization 1939 population Census of Manufactures
(d) % of 1940 population which were native white
(e) Average size of farm according to the Census of Agriculture
2. One primary area per stratum was selected in a random manner from the list of areas for each Stratum -
Each of 3,54 Primary Areas is divided into two parts
(a) cities, Towns, Villages

Names:
Statistical Notes

Types:
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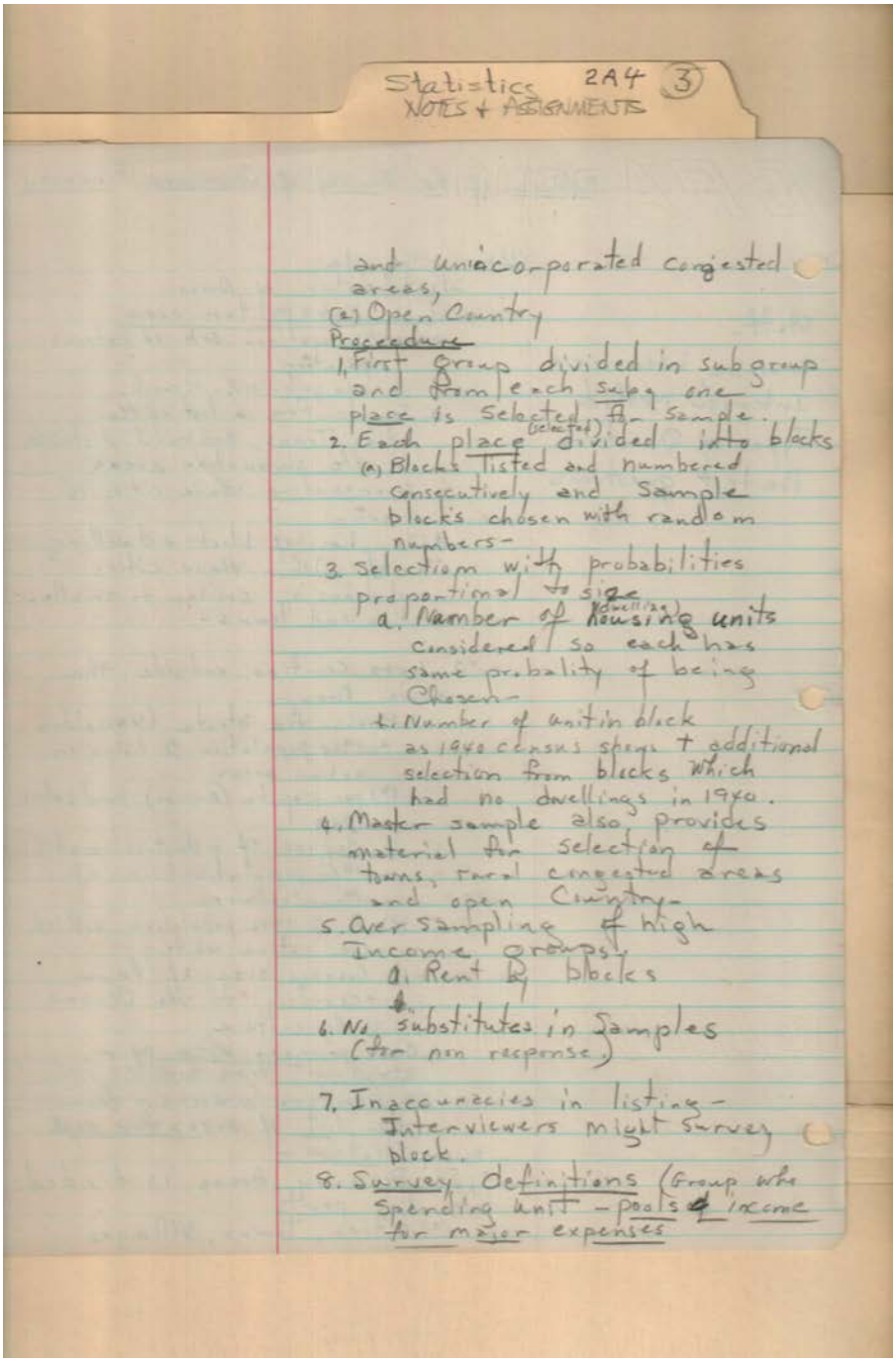
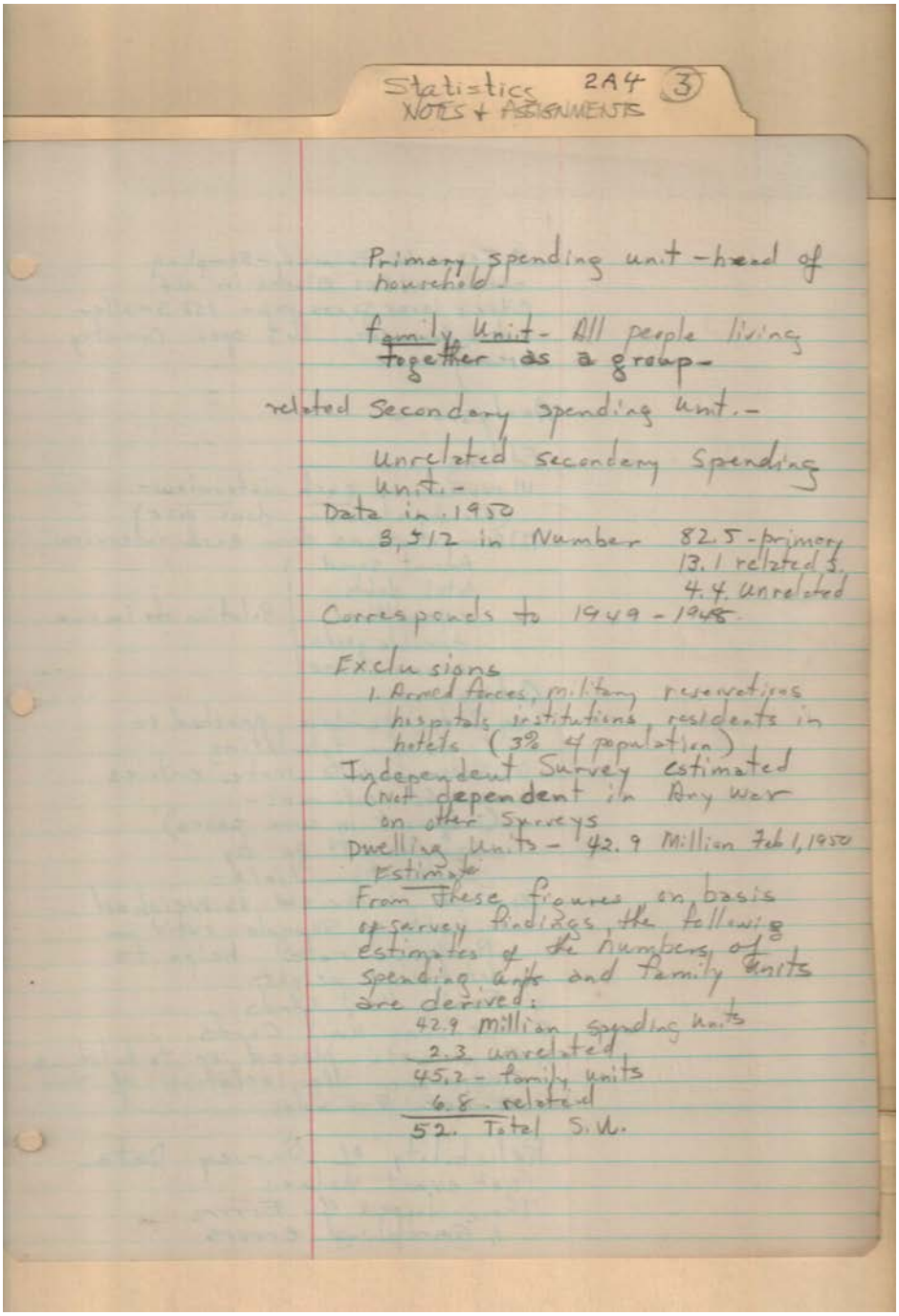


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

and unincorporated congested areas,
(2) Open Country
Procedures
1. First group divided in subgroup and from each subg one place is selected (selected) for sample.
2. Each place divided into blocks
(a) Blocks listed and numbered consecutively and sample blocks chosen with random numbers-
3. Selection with probabilities proportional to size
a. Number of housing (dwelling) units considered so each has same probality of being chosen-
b. Number of unit in block as 1940 census steps + additional selection from blocks which had no dwellings in 1940.
4. Master sample also provides material for selecting of towns, rural congested areas and open Country-
5. Over sampling of high Income groups.
a. Rent by blocks
6. No substitutes in samples (for non response)
7. Inaccuracies in listing - Interviewers might survey block.
8. Survey definitions (Group who spending unit - pools of income for major expenses

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Primary spending unit - head of household.

family Unit - All people living together as a group -

related Secondary spending unit. -

Unrelated secondary Spending unit. -

Data in 1950

3,512 in Number 82.5 - primary
13.1 related S.
4.4. Unrelated

Corresponds to 1949 - 1948.

Exclusions

1. Armed forces, military reservations hospitals institutions, residents in hotels (3% of population)

Independent Survey estimated (Not dependent in Any way on other Surveys

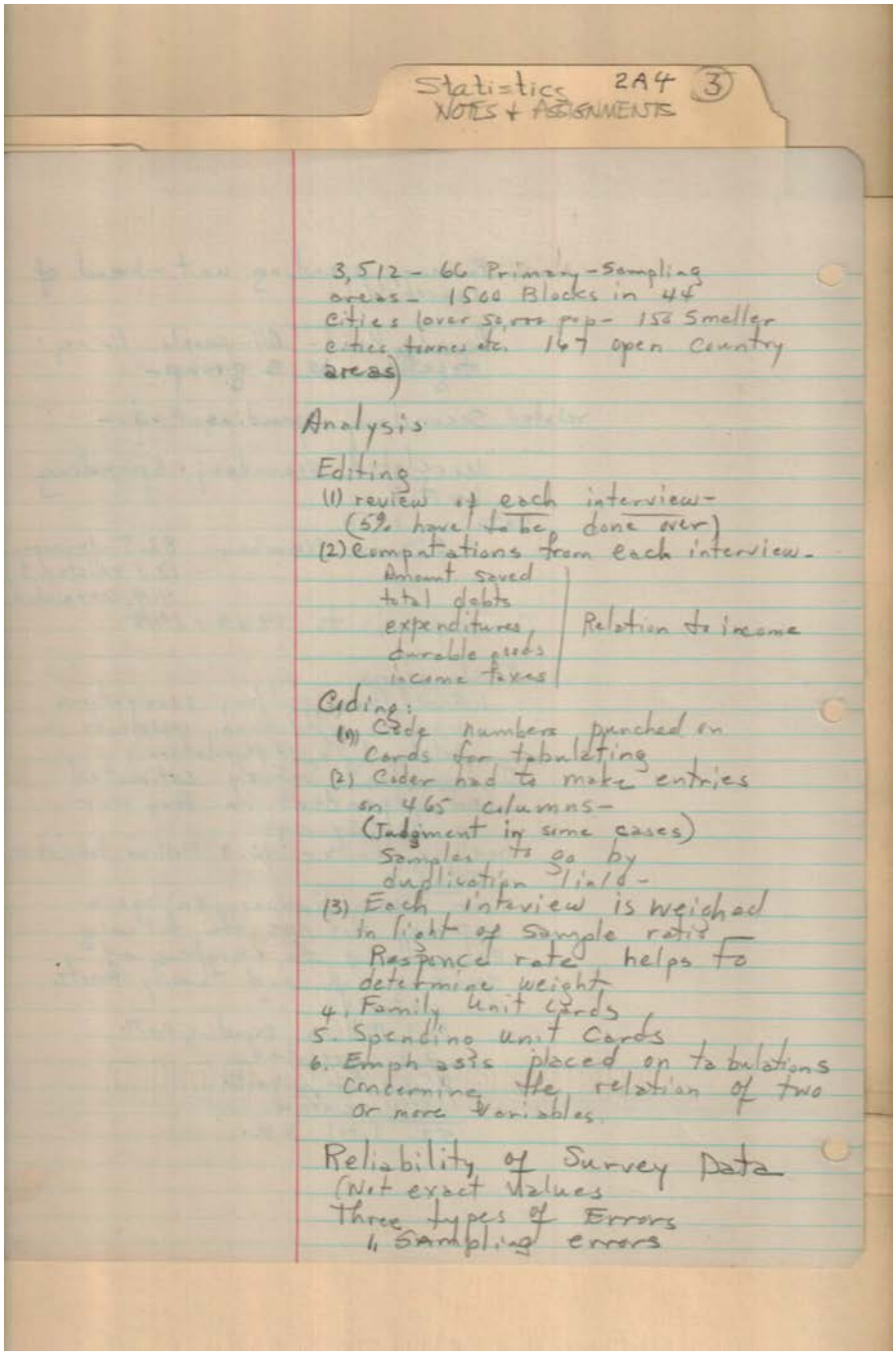
Dwelling Units - 42.9 Million Feb 1, 1950 Estimate

From these figures on basis of survey findings, the following estimates of the numbers of Spending Units and family Units are derived:

42.9 million spending Units
2.3 unrelated
45.2 - family units
6.8 - related
52. Total S.U.

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

3,512 - 66 Primary-Sampling areas - 1500 Blocks in 44 cities (over 50,000 pop - 158 Smaller cities towns etc. 164 open country areas)

Analysis

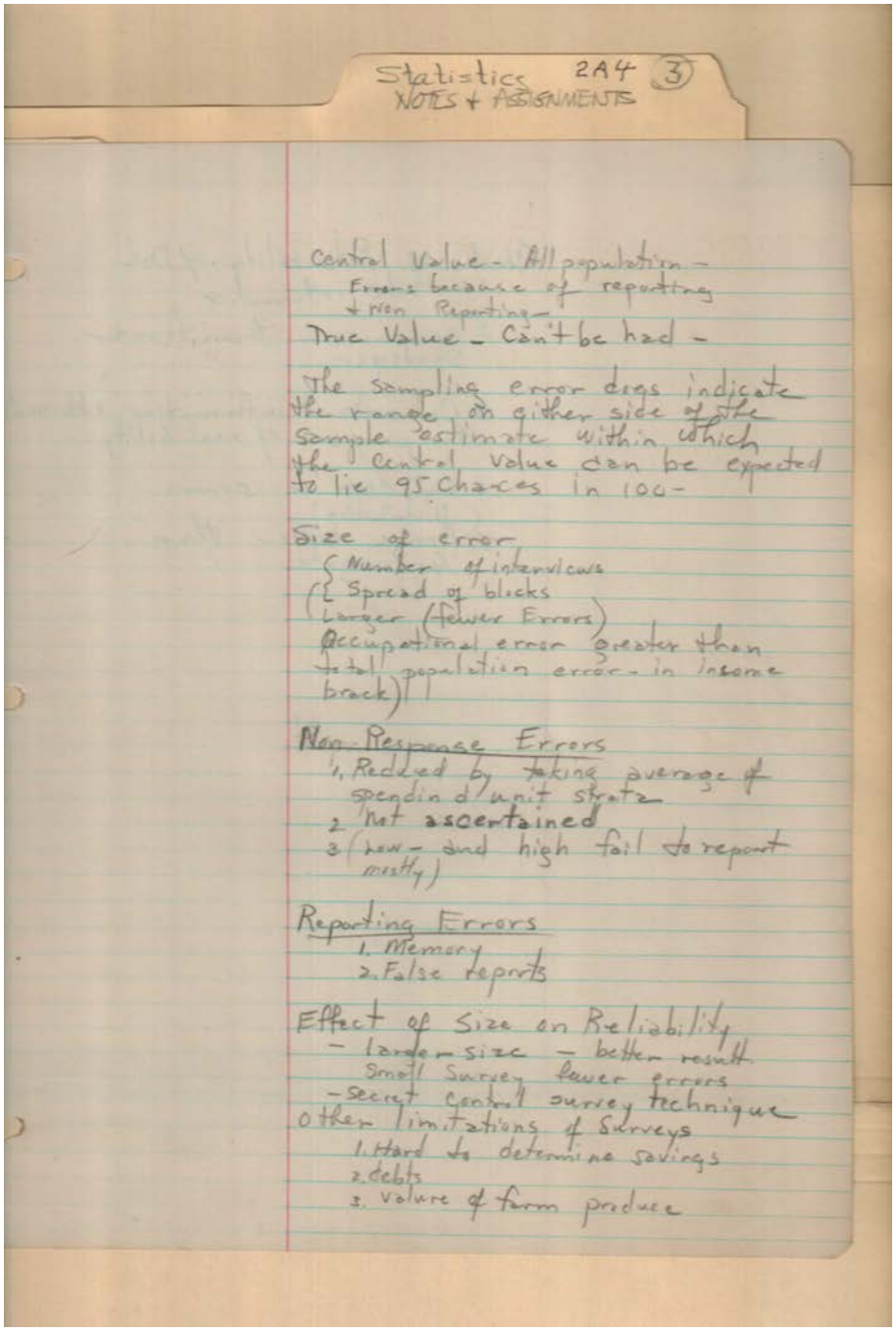
Editing
(1) review of each interview - (5% have to be done over)
(2) Computations from each interview.
Amount saved
total debts
expenditures, durable goods
income taxes
} Relation to income

Coding:
(1) Code numbers punched on cards for tabulating
(2) Coder had to make entries on 465 columns - (Judgment in some cases)
Samples to go by duplication Yield -
(3) Each interview is weighed in light of sample ratio
Responce rate helps to determine weight
4. Family Unit Cards
5. Spending unit Cards
6. Emphasis placed on tabulations concerning the relation of two or more variables.

Reliability of Survey Data
(Not exact values
Three types of Errors
1. Sampling errors

Names:
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Central Value - All population -
Errors because of reporting
+ non Reporting -
True Value - Can't be had -

The sampling error does indicate the range on either side of the sample estimate within which the central value can be expected to lie 95 chances in 100 -

Size of error
{ Number of interviews
{ Spread of blocks
Larger (fewer Errors)
Occupational error greater than total population error - in income brack)

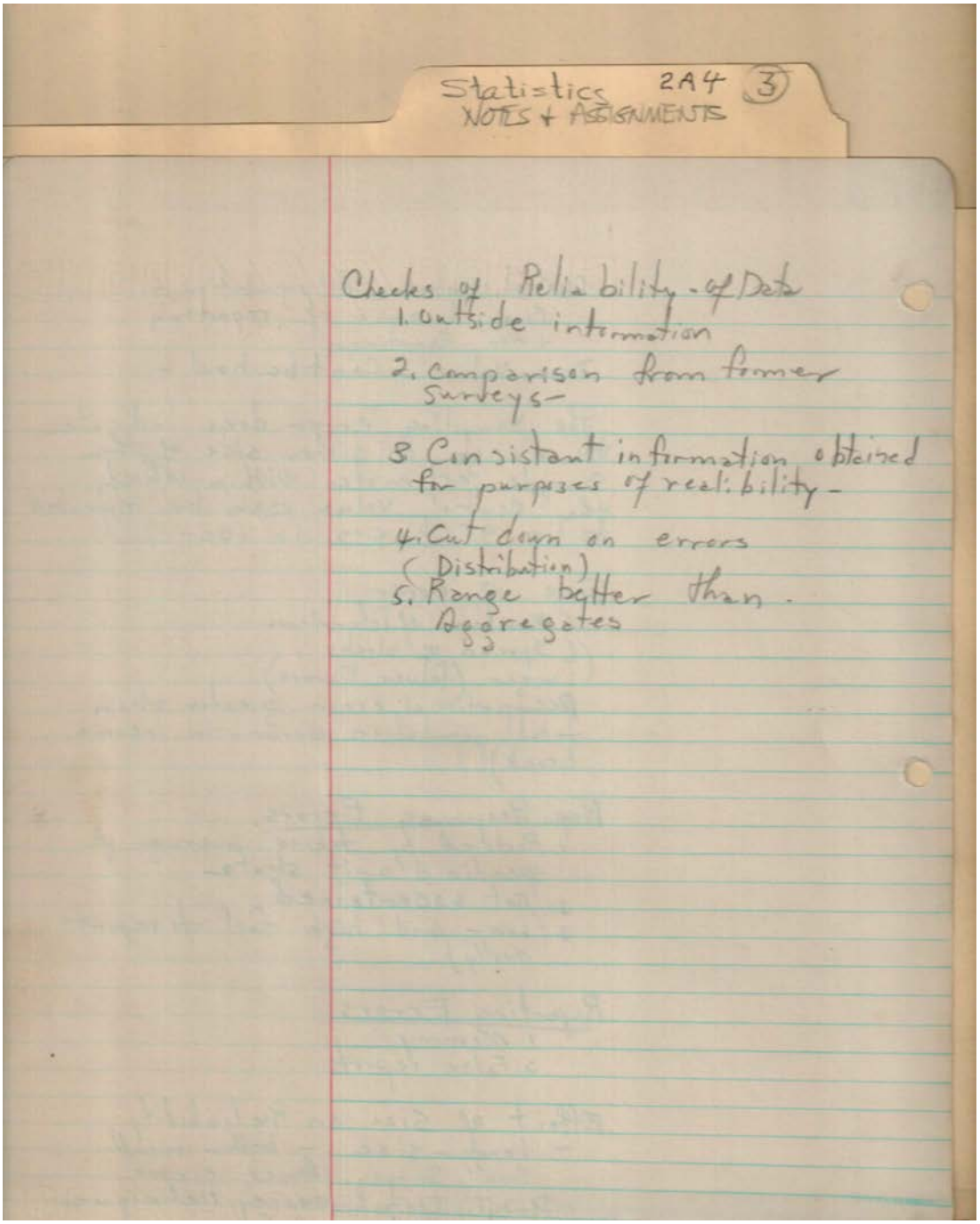
Non Response Errors
1. Reduced by taking average of spending unit strata
2. Not ascertained
3. (low - and high fail to report mostly)

Reporting Errors
1. Memory
2. False reports

Effect of Size on Reliability
- larger size - better result
Small Survey fewer errors
- Secret Control survey technique
Other limitations of Surveys
1. Hard to determine savings
2. debts
3. Value of farm produce

Names:
Statistical Notes

Types:
notes



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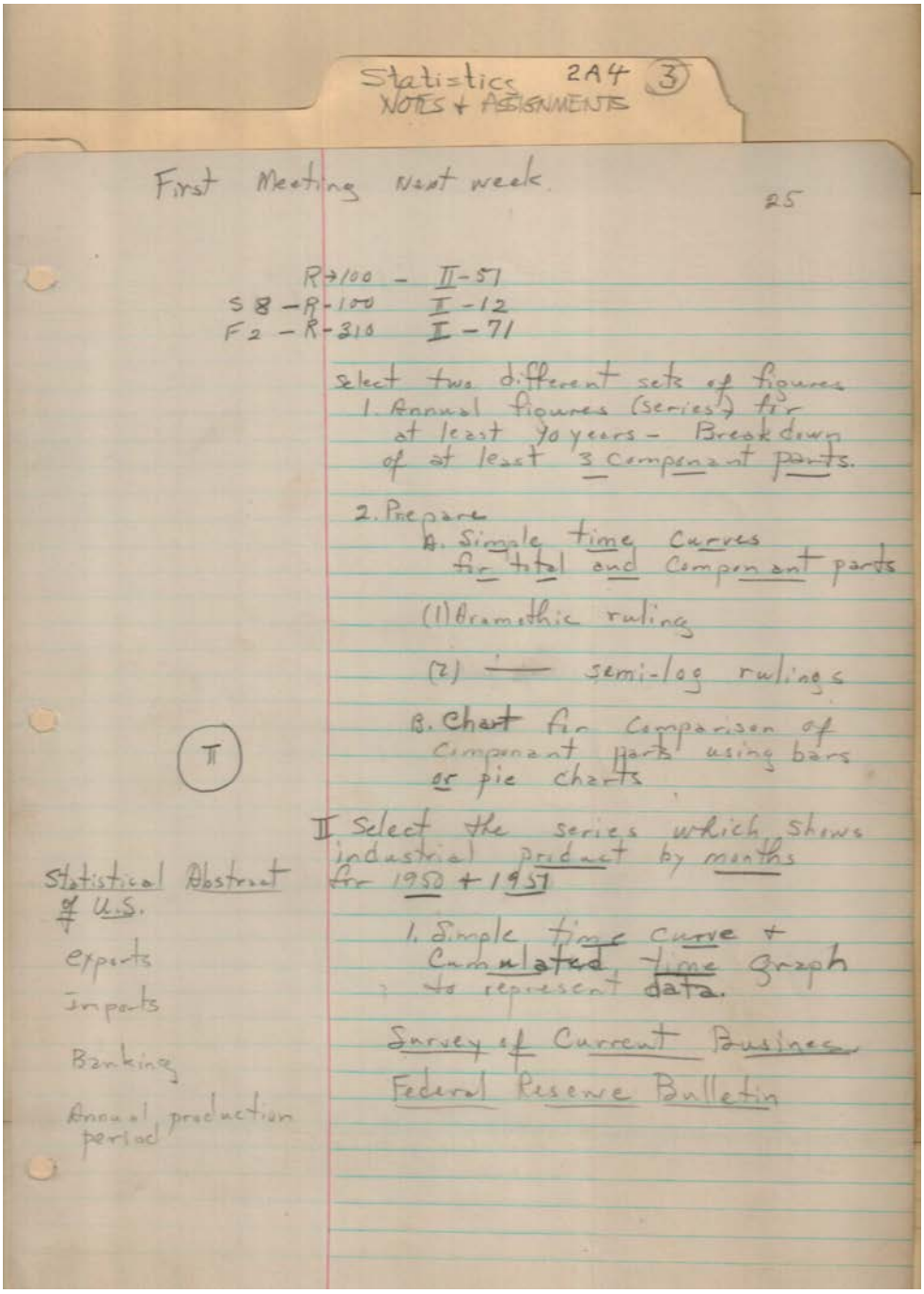


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

First Meeting Next week.

25

R→100 - II-57
S 8 - R-100 I-12
F2 - R-310 I-71

Select two different sets of figures
1. Annual figures (series) for at least 30 years - Breakdown of at least 3 component parts.

2. Prepare
A. Simple time curves for total and component parts
(1) Arithmetic ruling
(2) — semi-log rulings
B. Chart for comparison of component parts using bars or pie charts

(T)

II Select the series which shows industrial product by months for 1950 + 1957

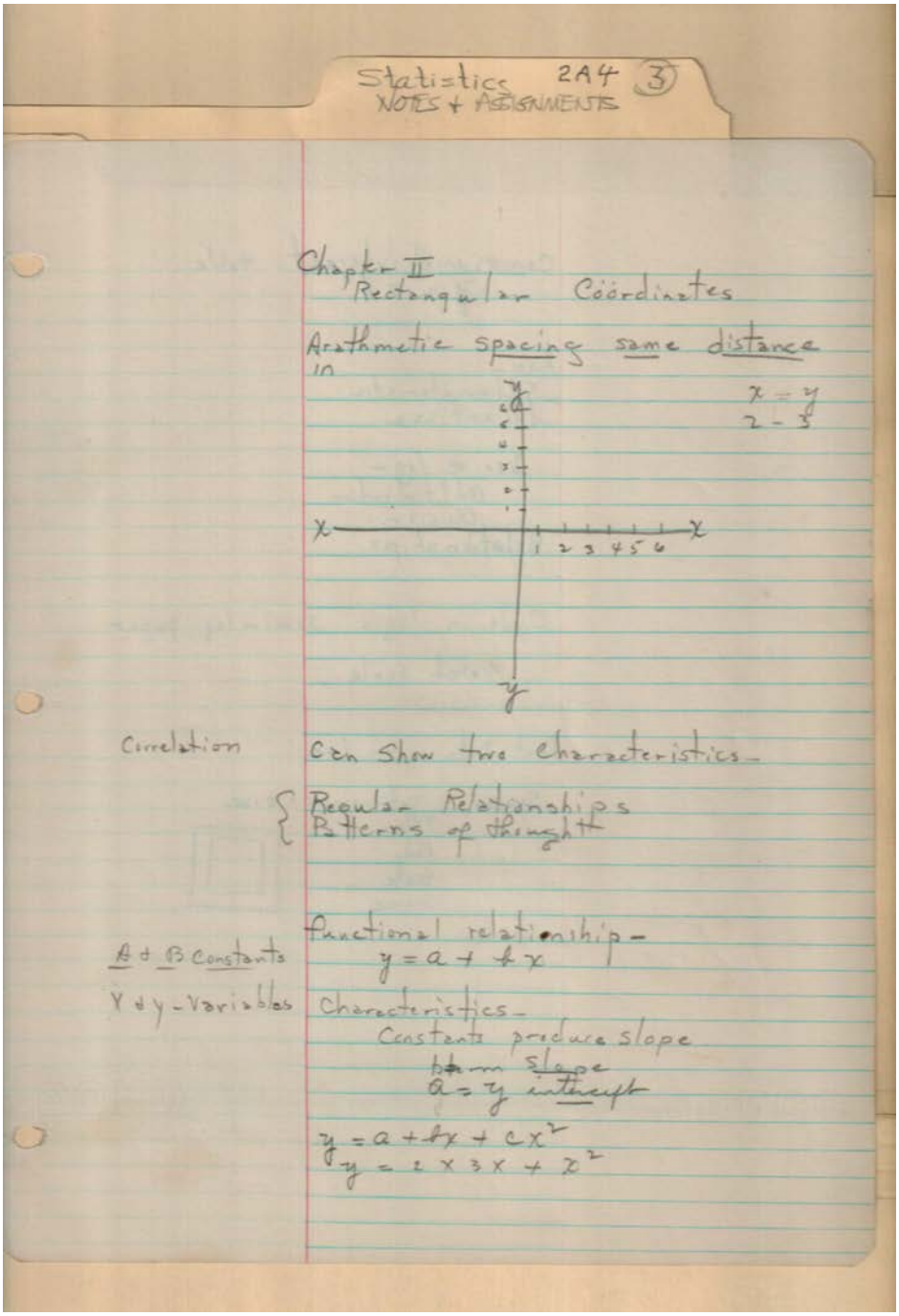
1. Simple time curve + Cumulated time graph to represent data.

Statistical Abstract of U.S.
exports
imports
Banking
Annual production period

Survey of Current Business
Federal Reserve Bulletin

Names:
Statistical Notes

Types:
notes



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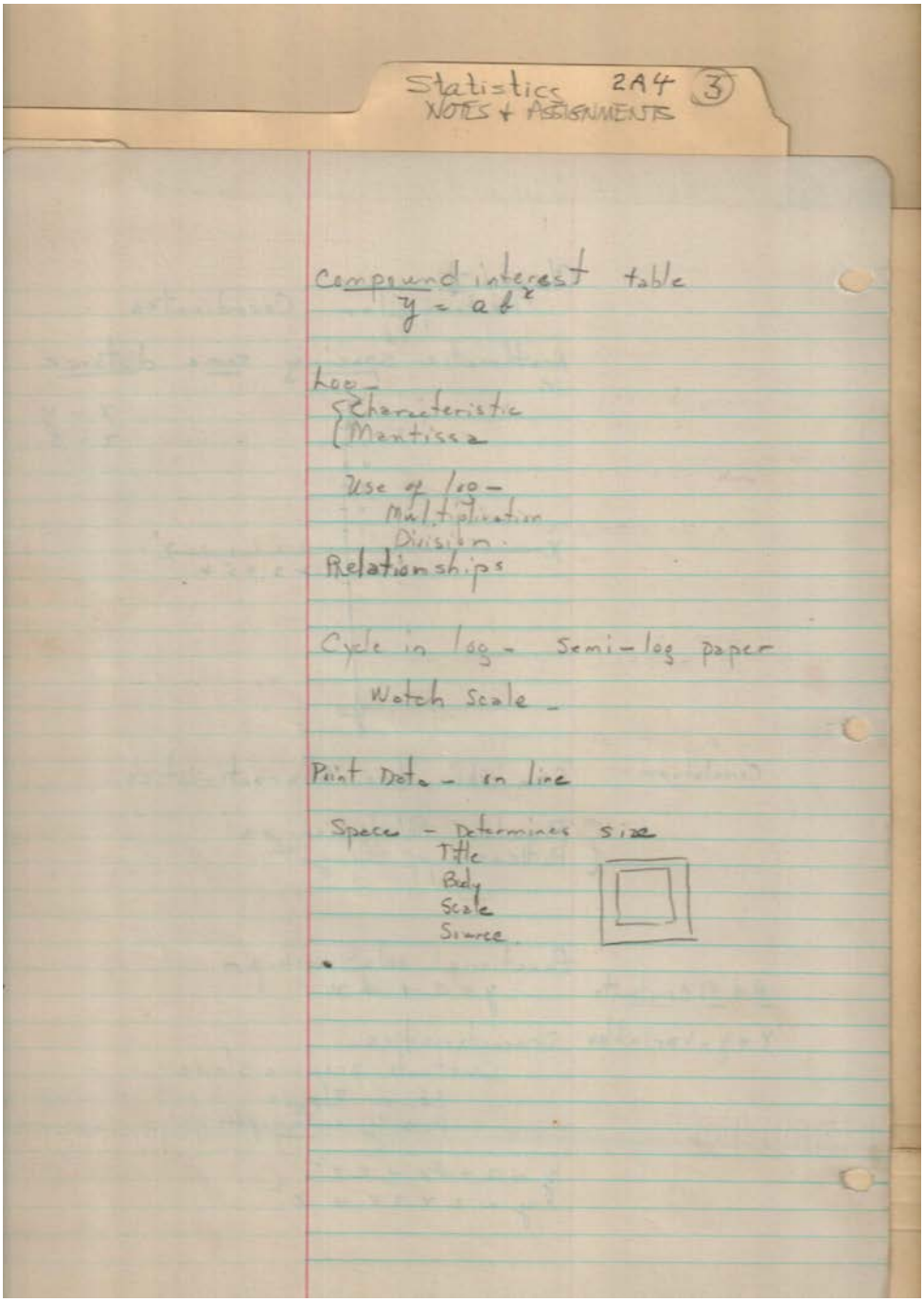

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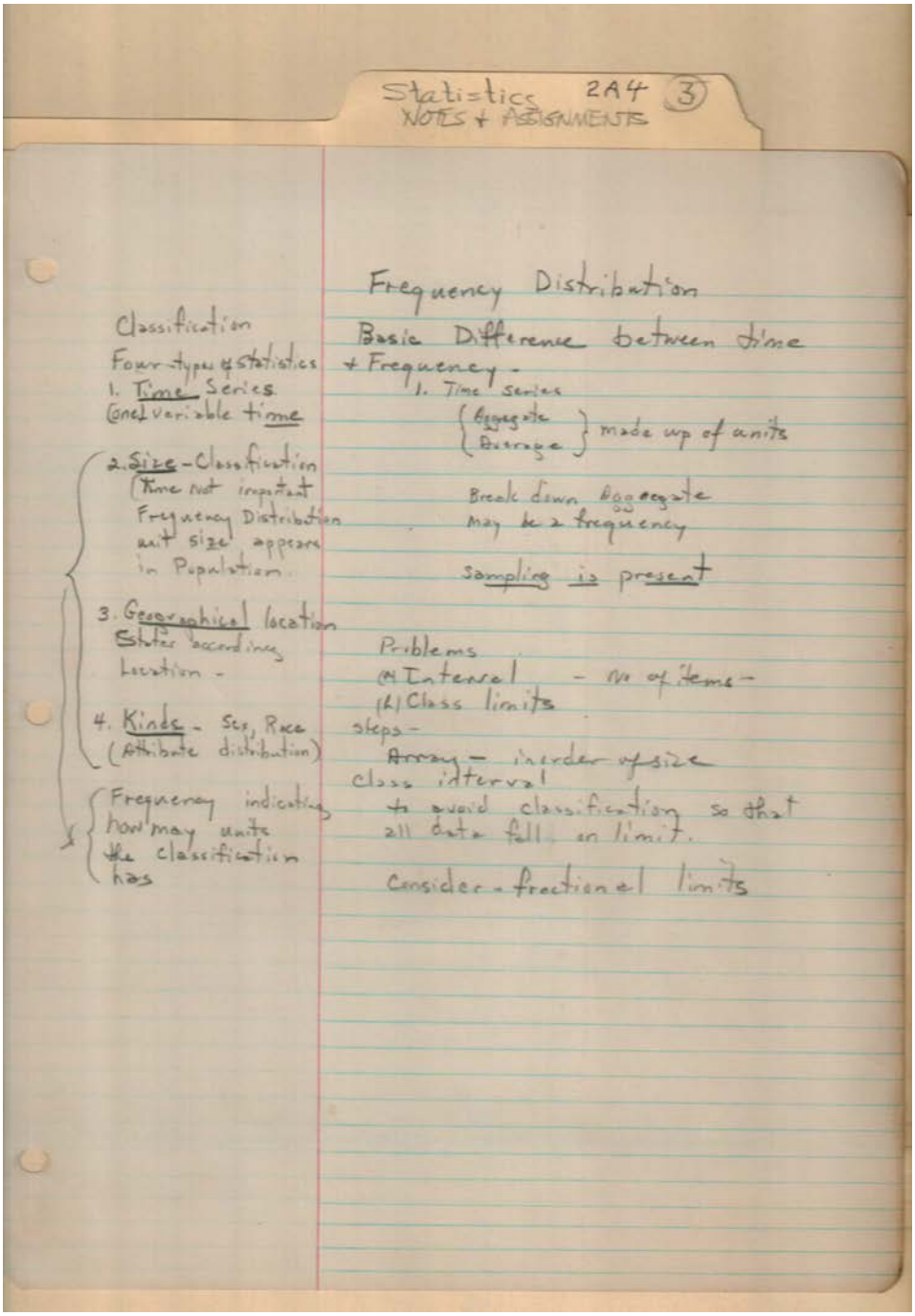

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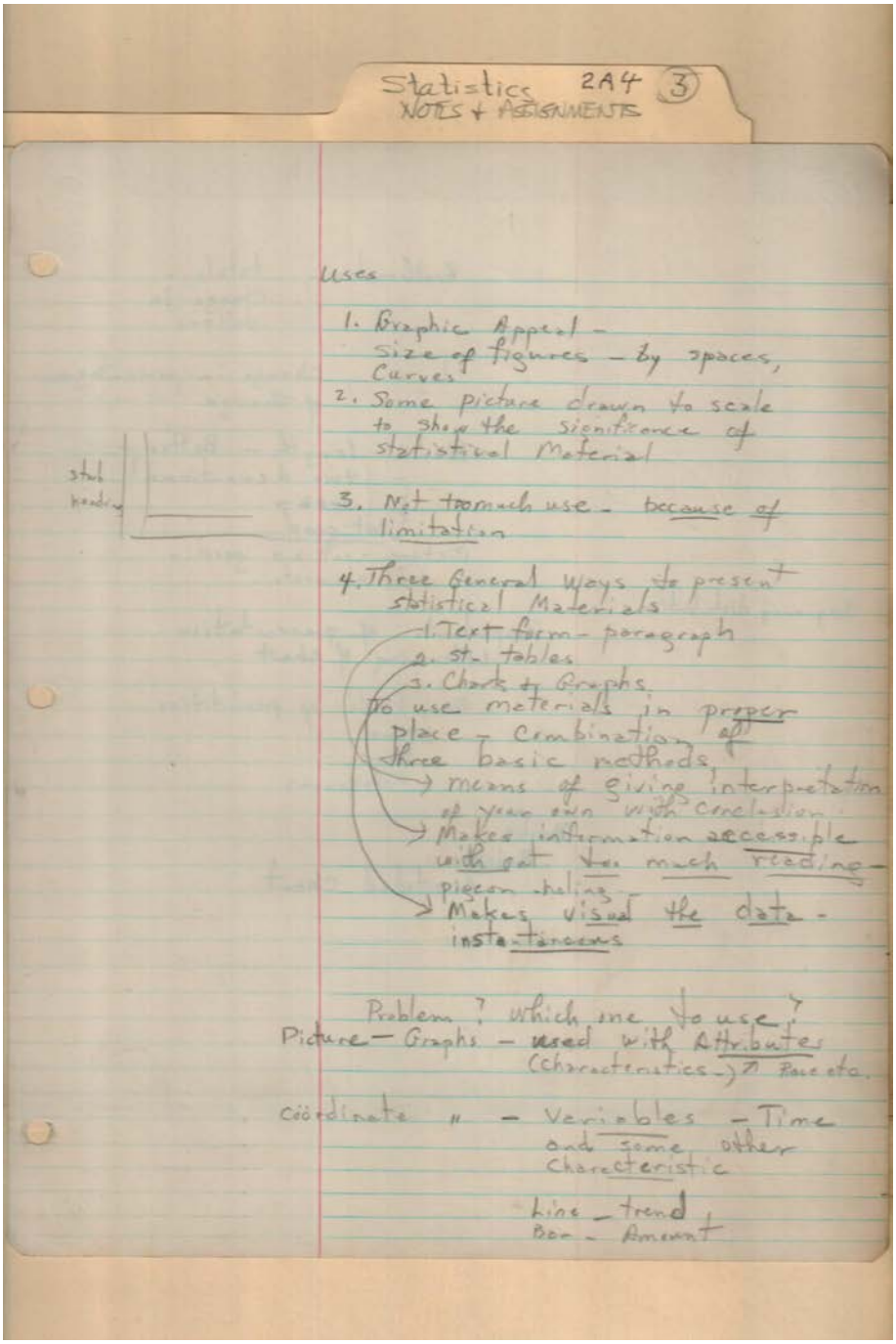

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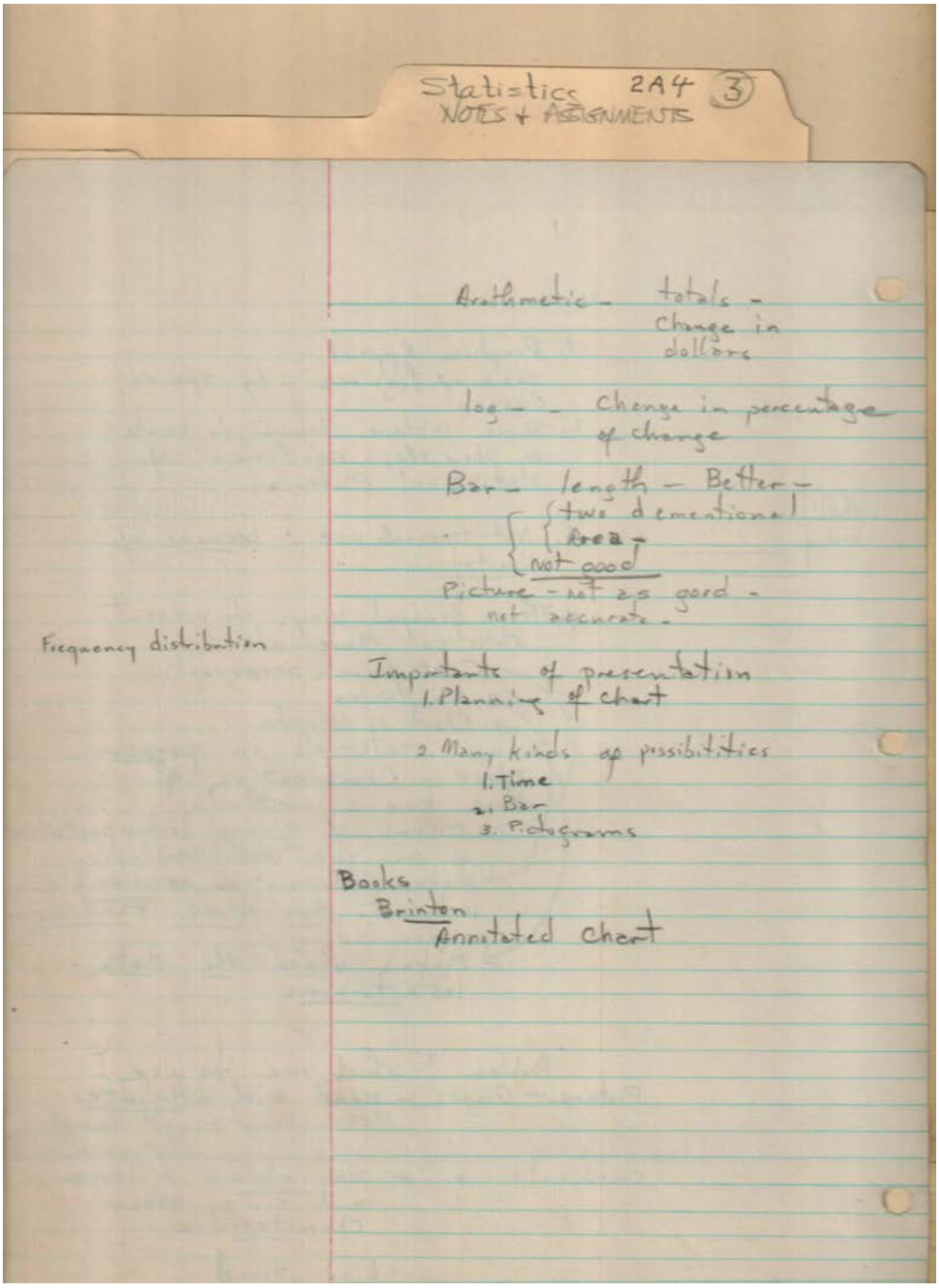

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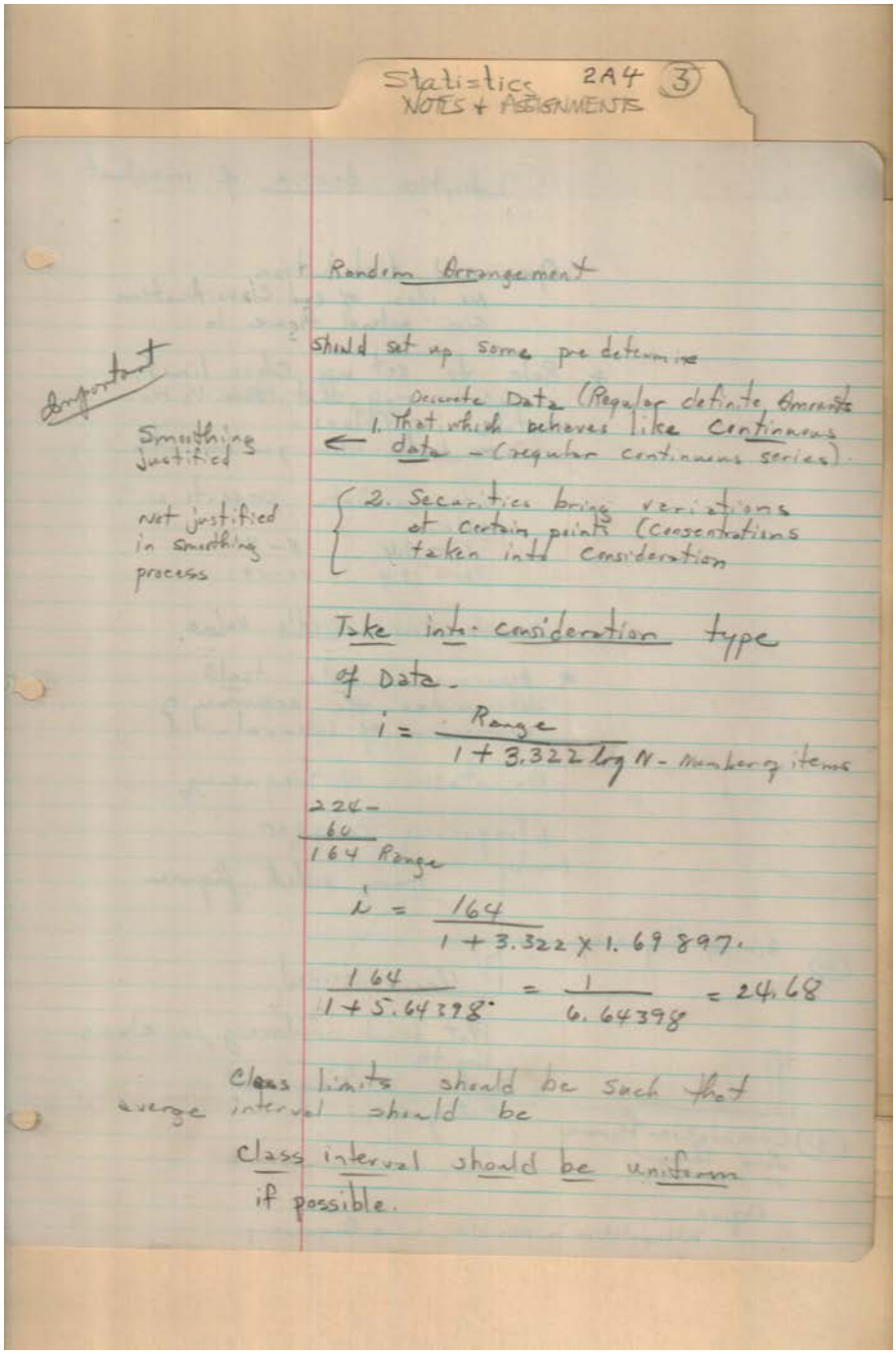

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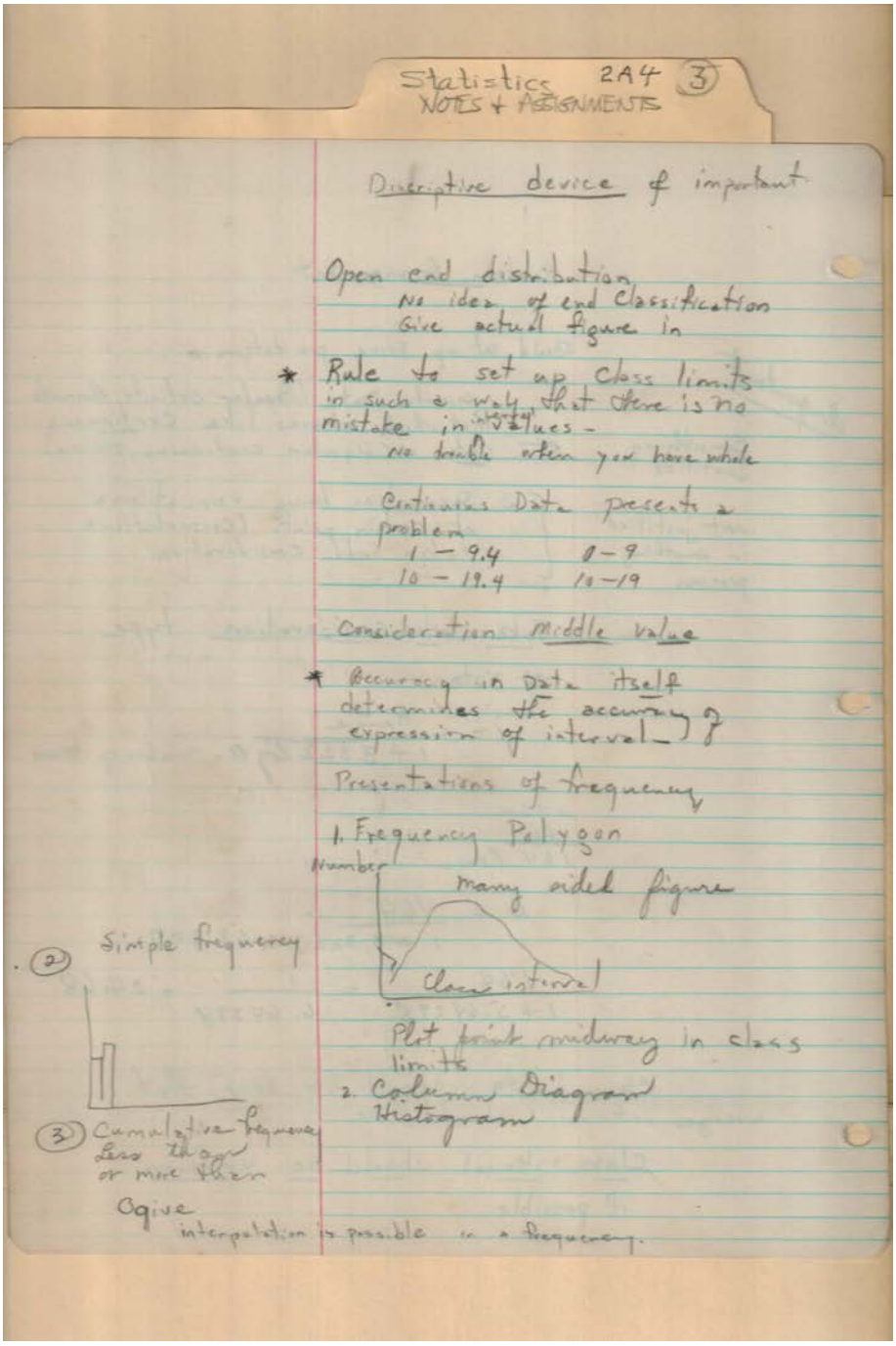

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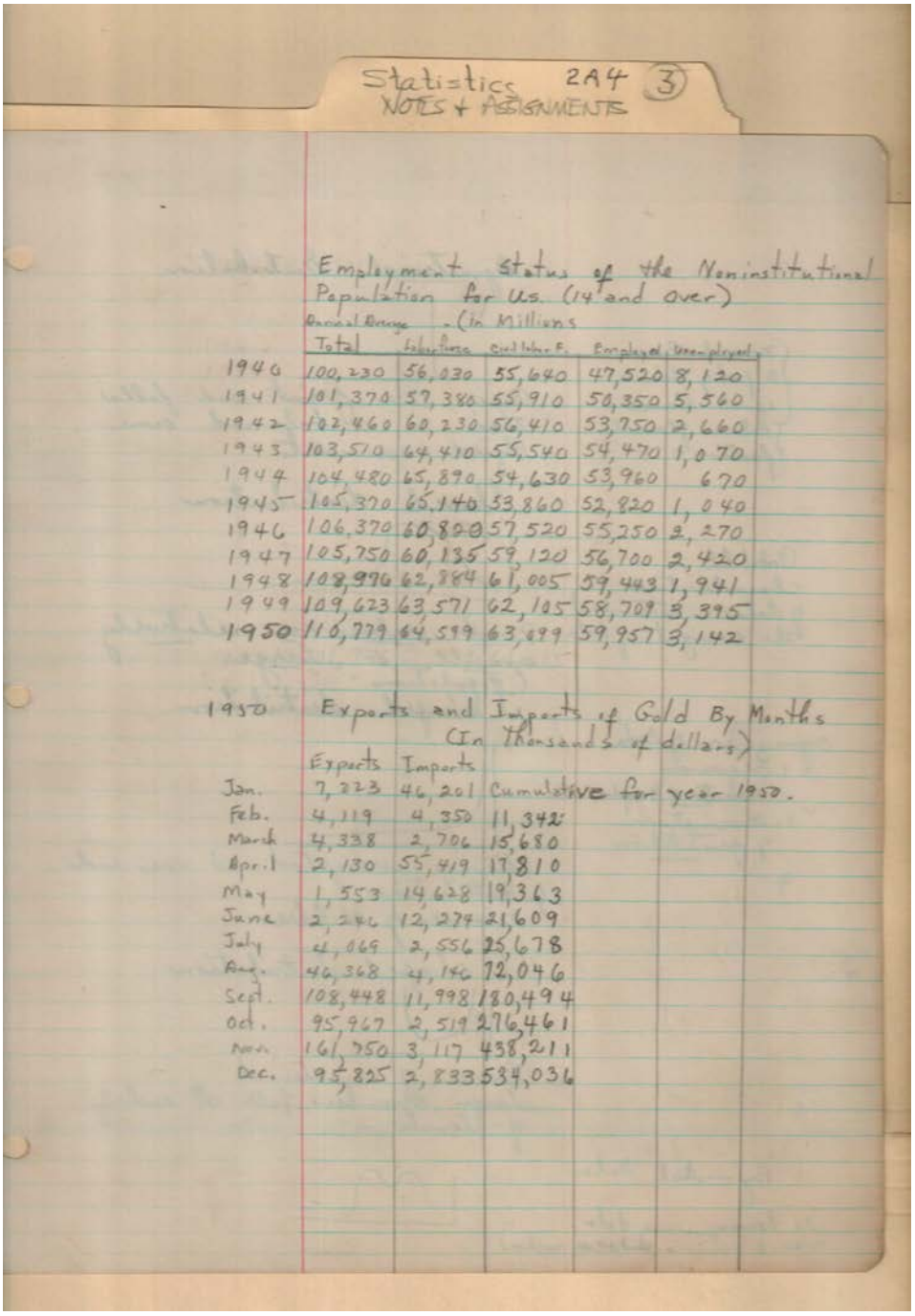


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Employment status of the Noninstitutional Population for U.S. (14 and over)
Annual Average - (in Millions)

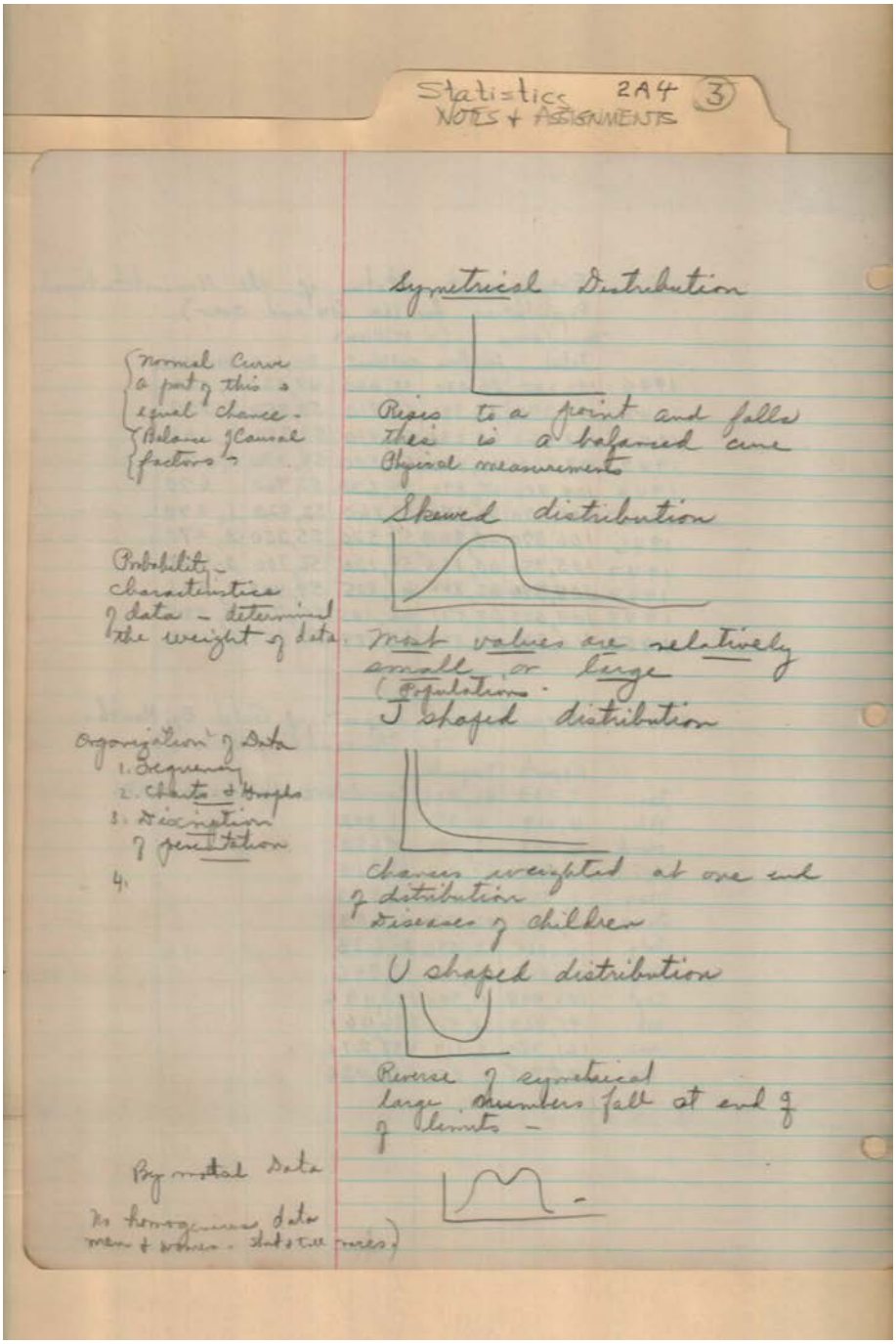
	Total	Labor Force	Civilian E.	Employed	Unemployed
1940	100,230	56,030	55,640	47,520	8,120
1941	101,370	57,380	55,910	50,350	5,560
1942	102,460	60,230	56,410	53,750	2,660
1943	103,510	64,410	55,540	54,470	1,070
1944	104,480	65,890	54,630	53,960	670
1945	105,370	65,140	53,860	52,820	1,040
1946	106,370	60,800	57,520	55,250	2,270
1947	105,750	60,135	59,120	56,700	2,420
1948	108,996	62,384	61,005	59,443	1,941
1949	109,623	63,571	62,105	58,709	3,395
1950	110,779	64,599	63,099	59,957	3,142

1950 Exports and Imports of Gold By Months
(In Thousands of dollars)

	Exports	Imports	
Jan.	7,223	46,201	Cumulative for year 1950.
Feb.	4,119	4,350	11,342
March	4,338	2,706	15,680
Apr.	2,130	55,419	17,810
May	1,553	14,628	19,363
June	2,246	12,279	21,609
July	4,069	2,556	25,678
Aug.	46,368	4,146	72,046
Sept.	108,448	11,998	180,494
Oct.	95,967	2,519	276,461
Nov.	161,750	3,117	438,211
Dec.	95,825	2,833	534,036

Names:
Statistical Notes

Types:
notes



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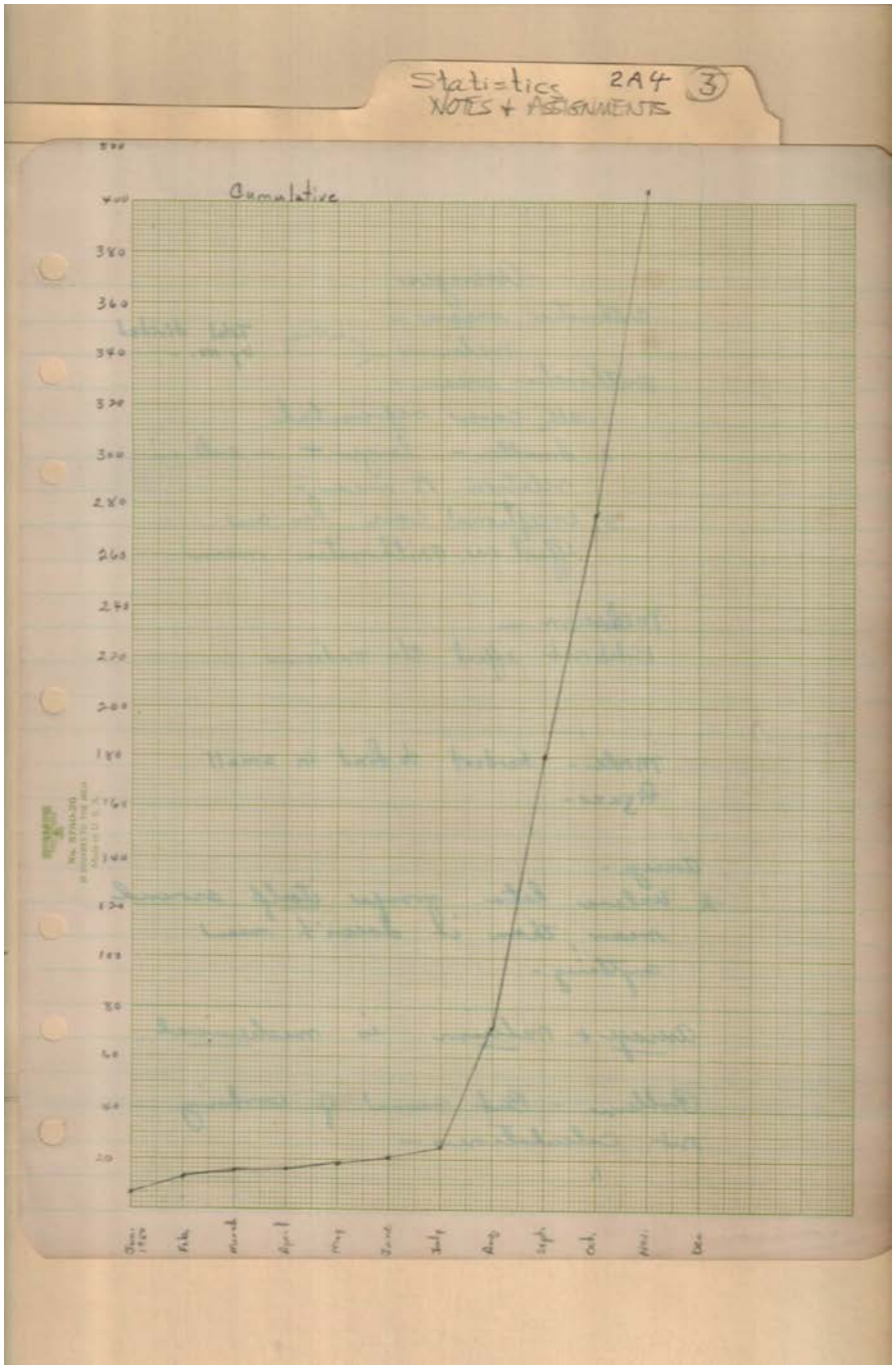

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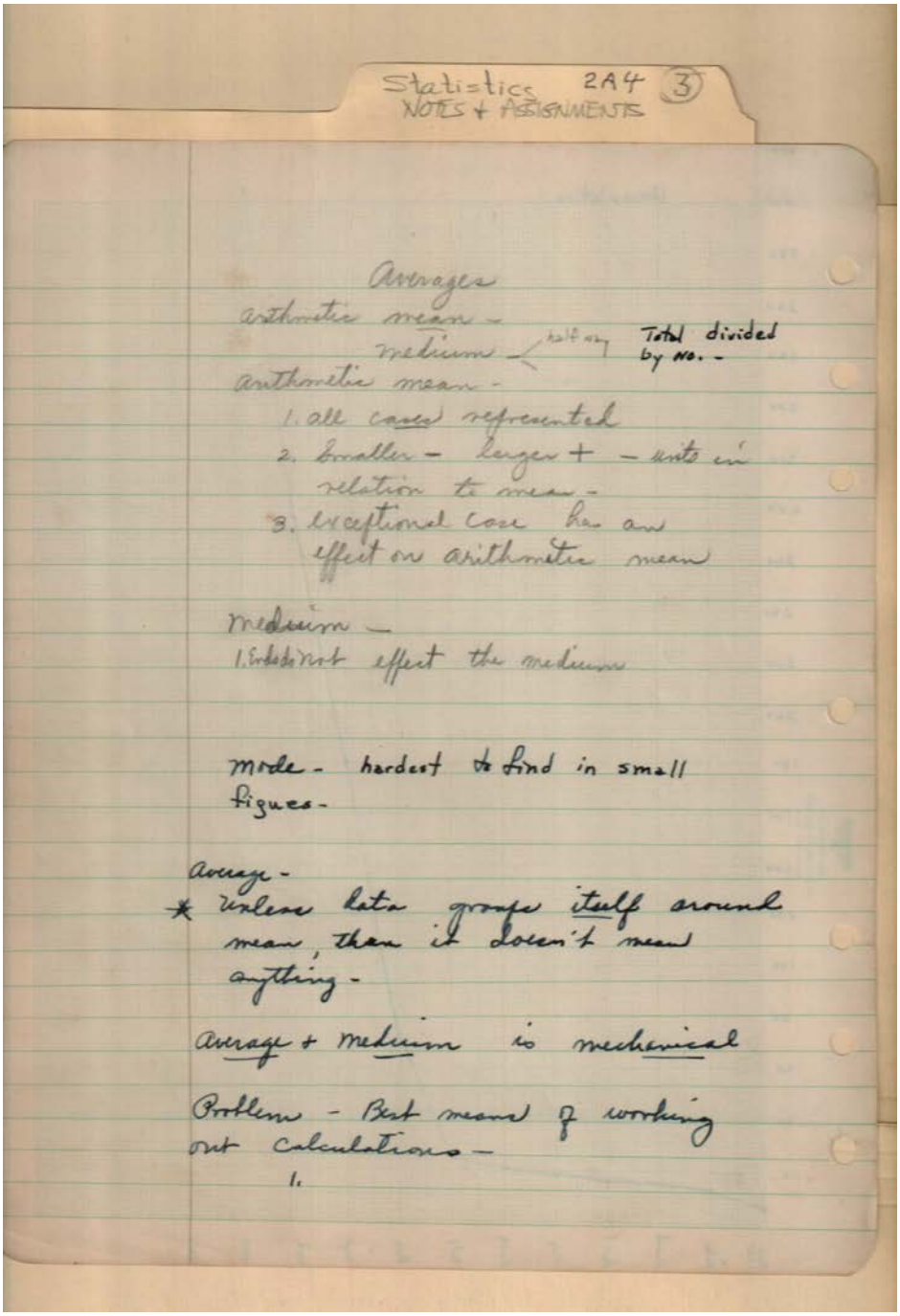

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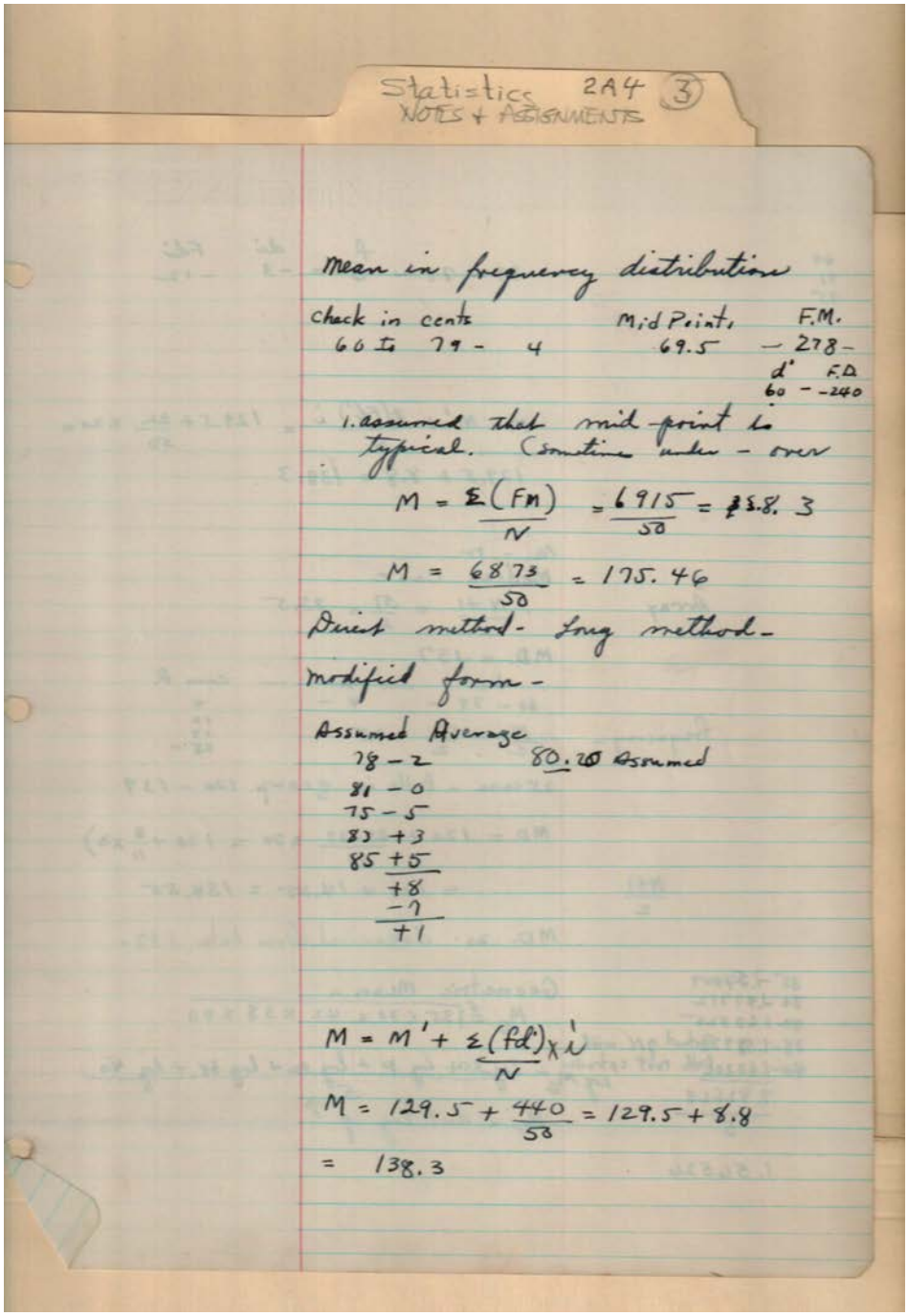

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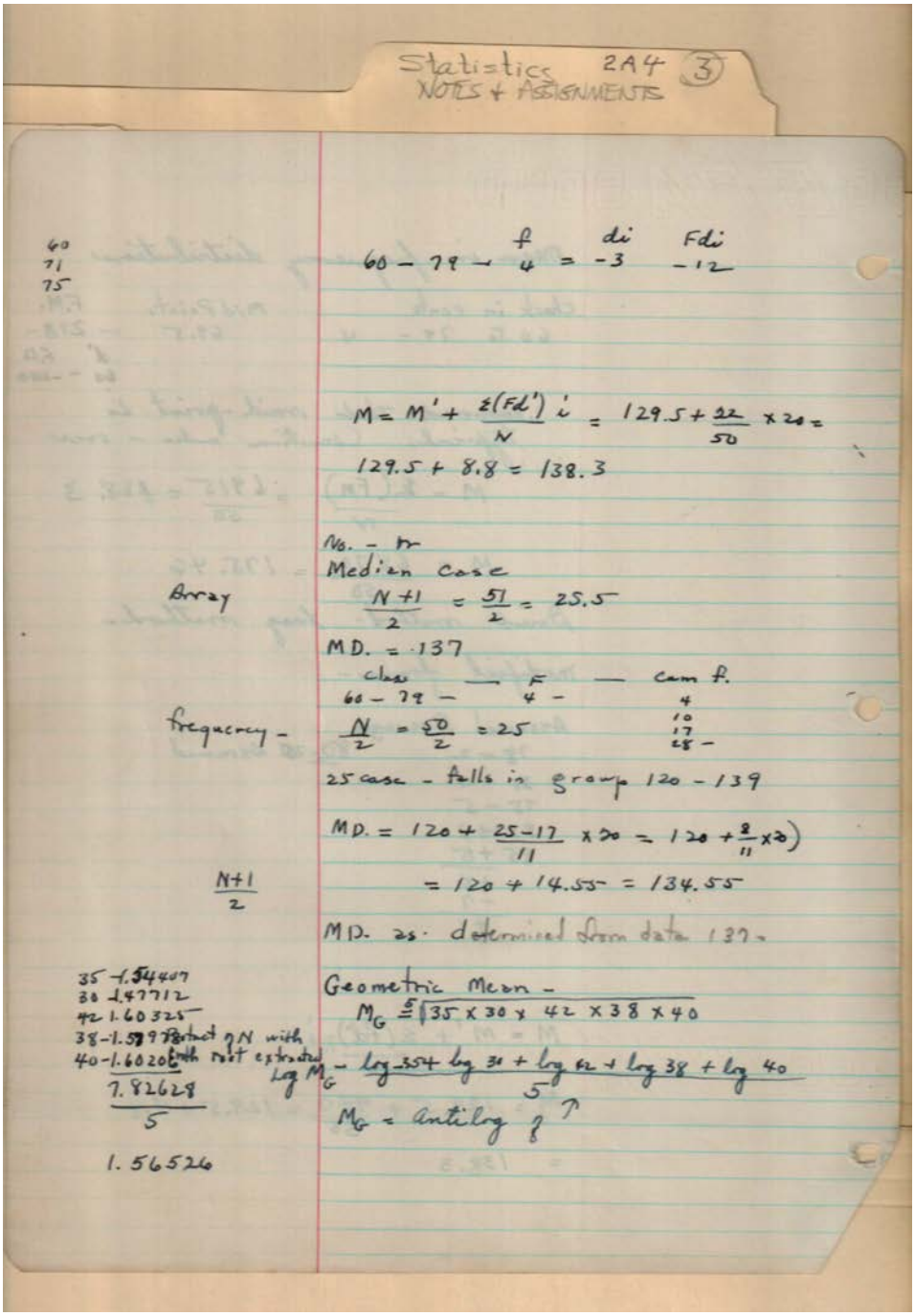

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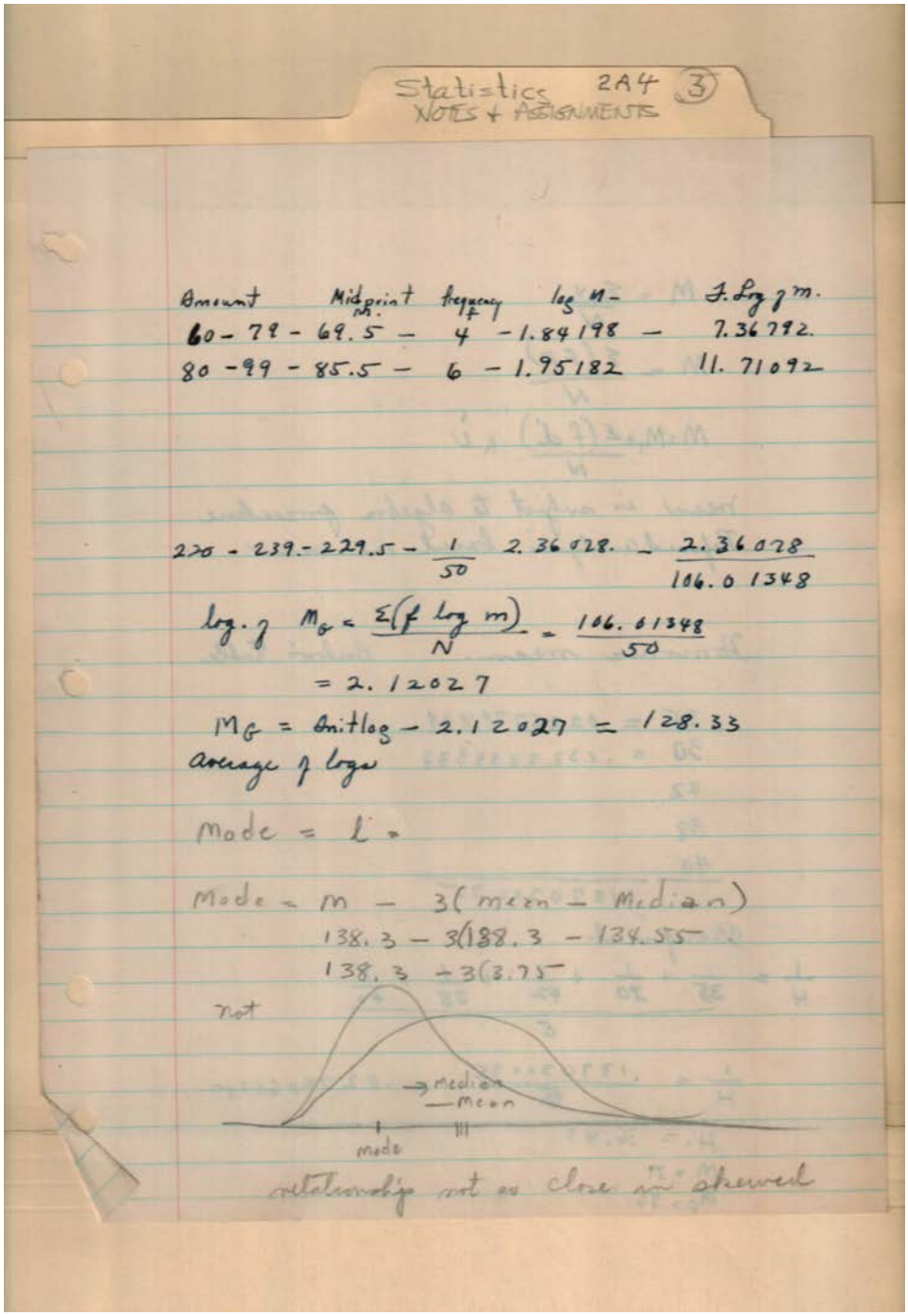

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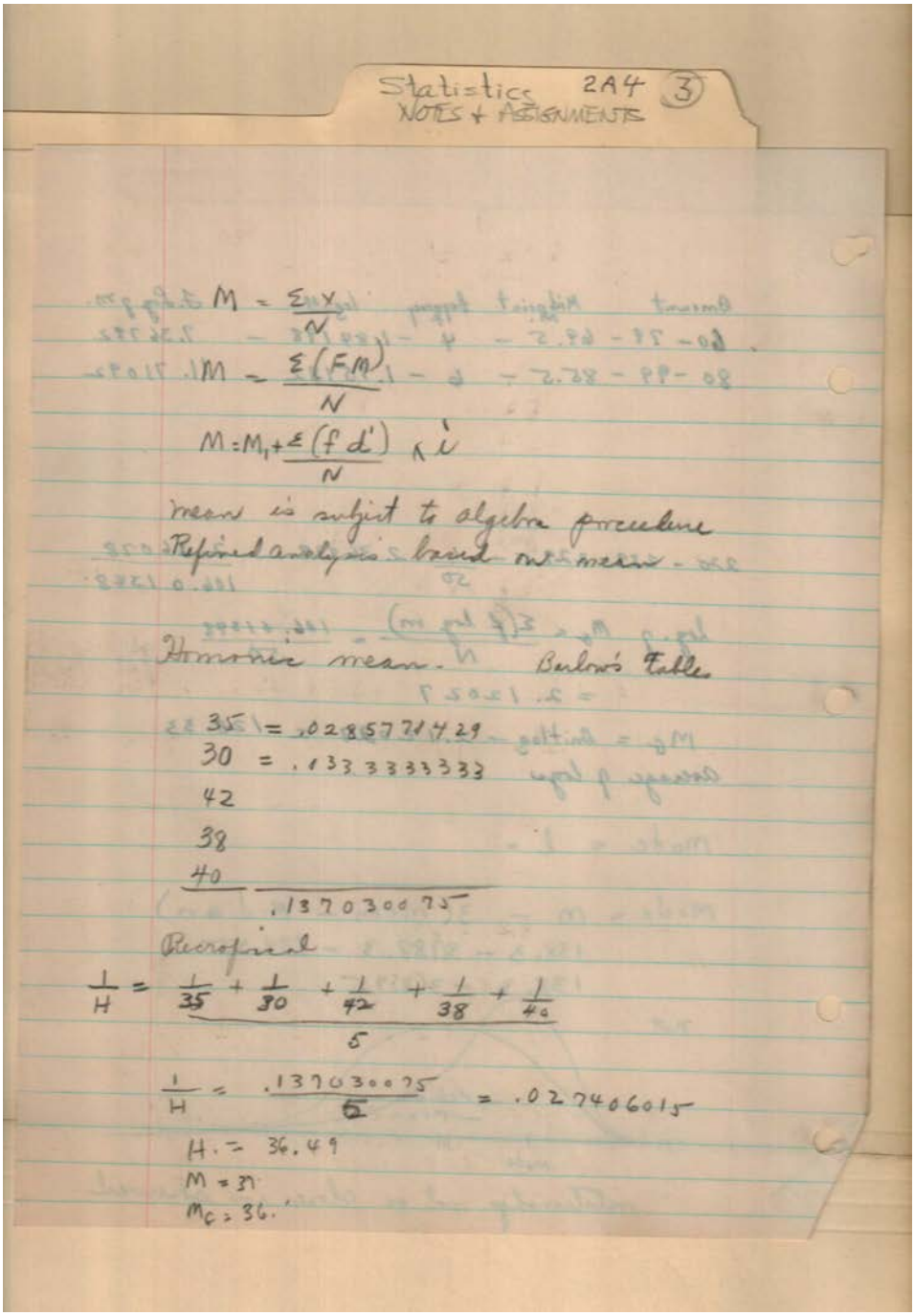

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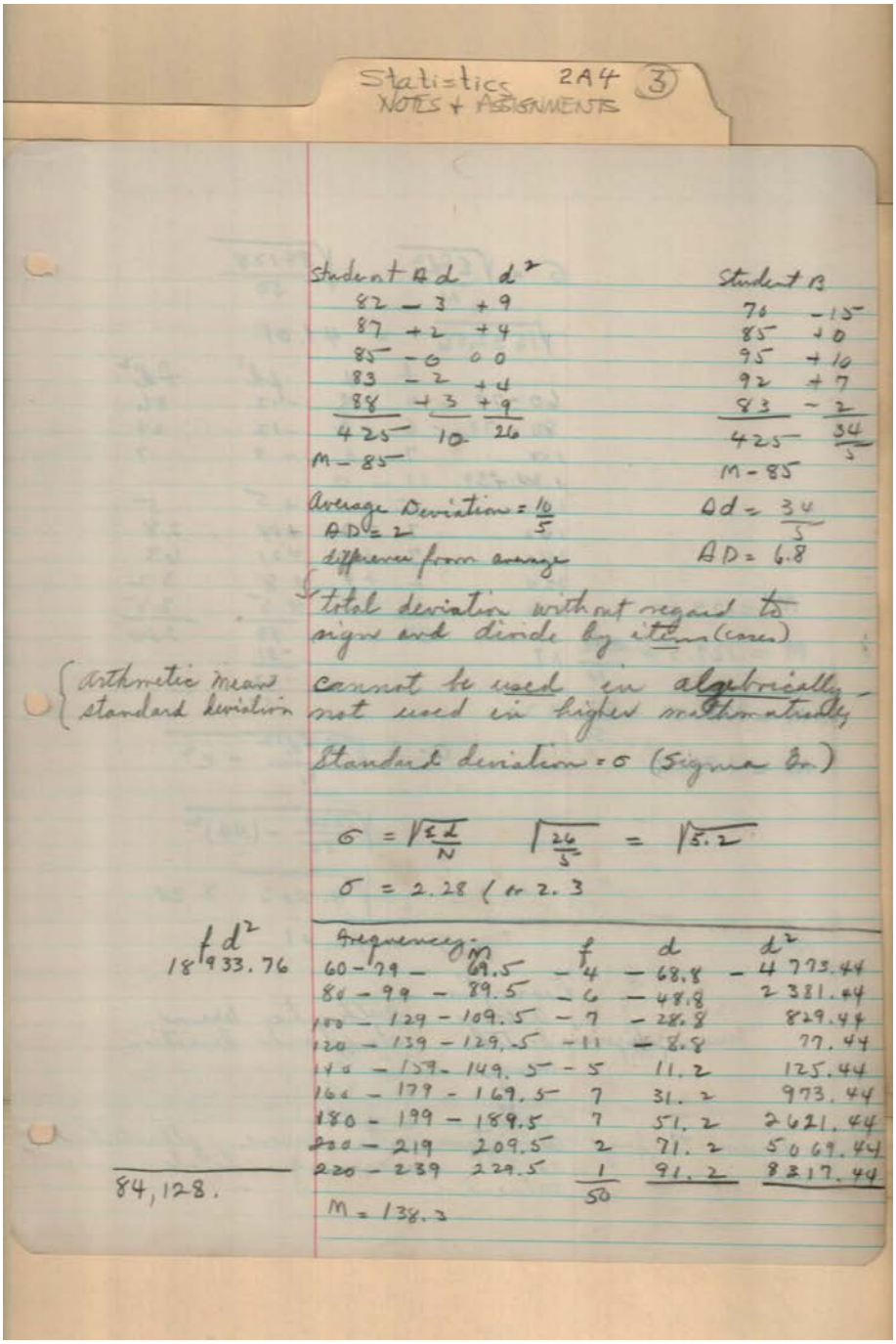

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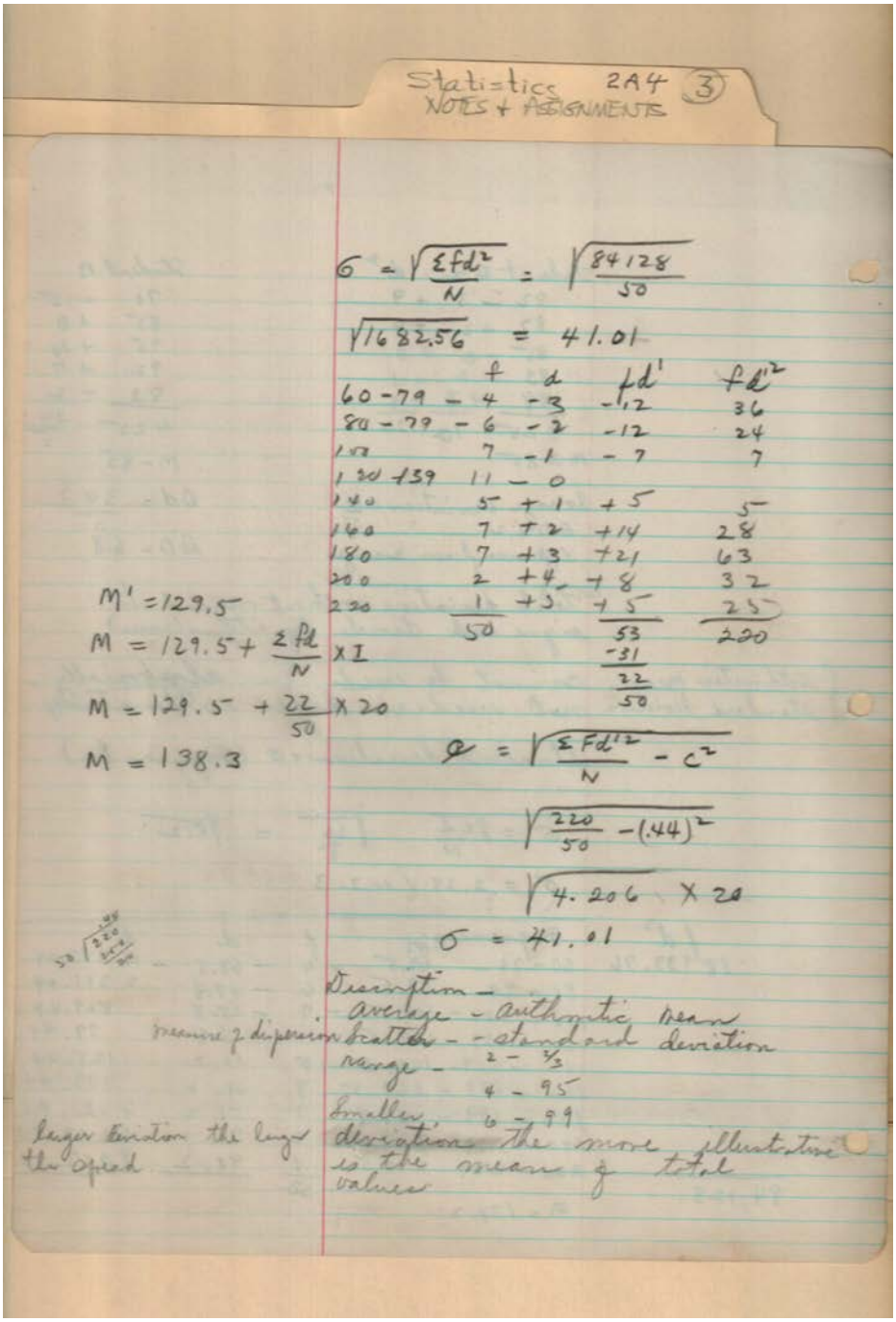

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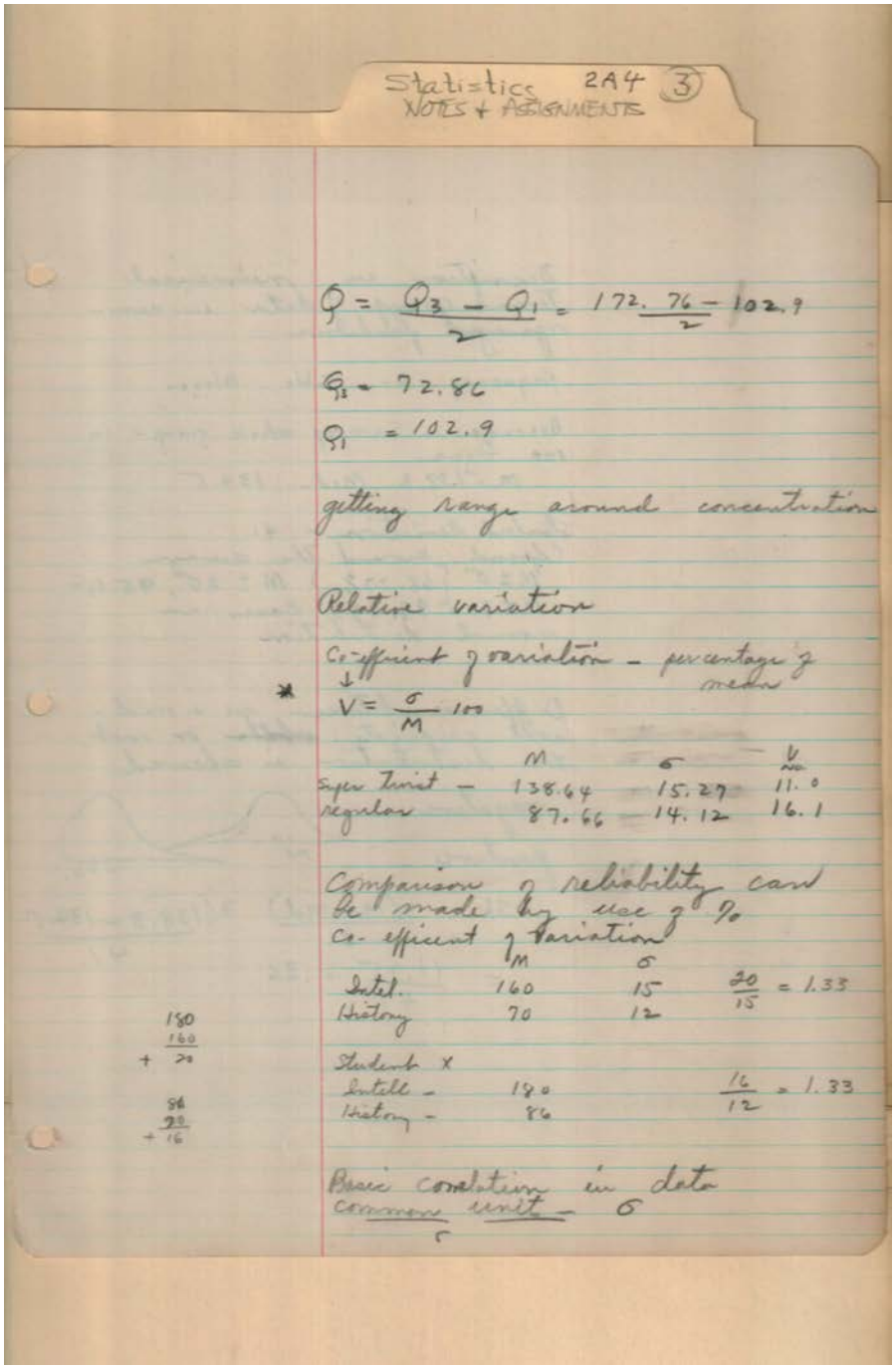

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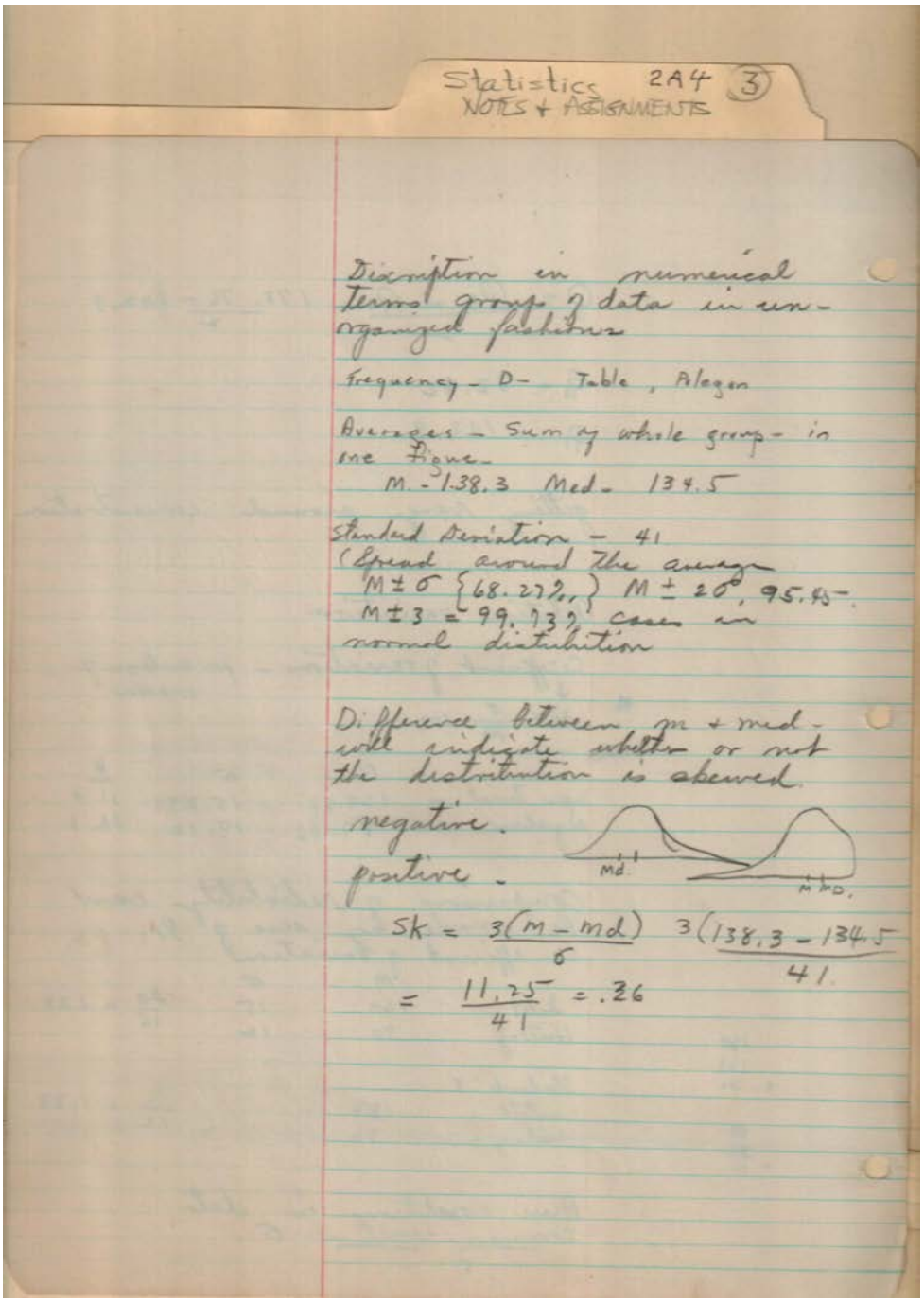

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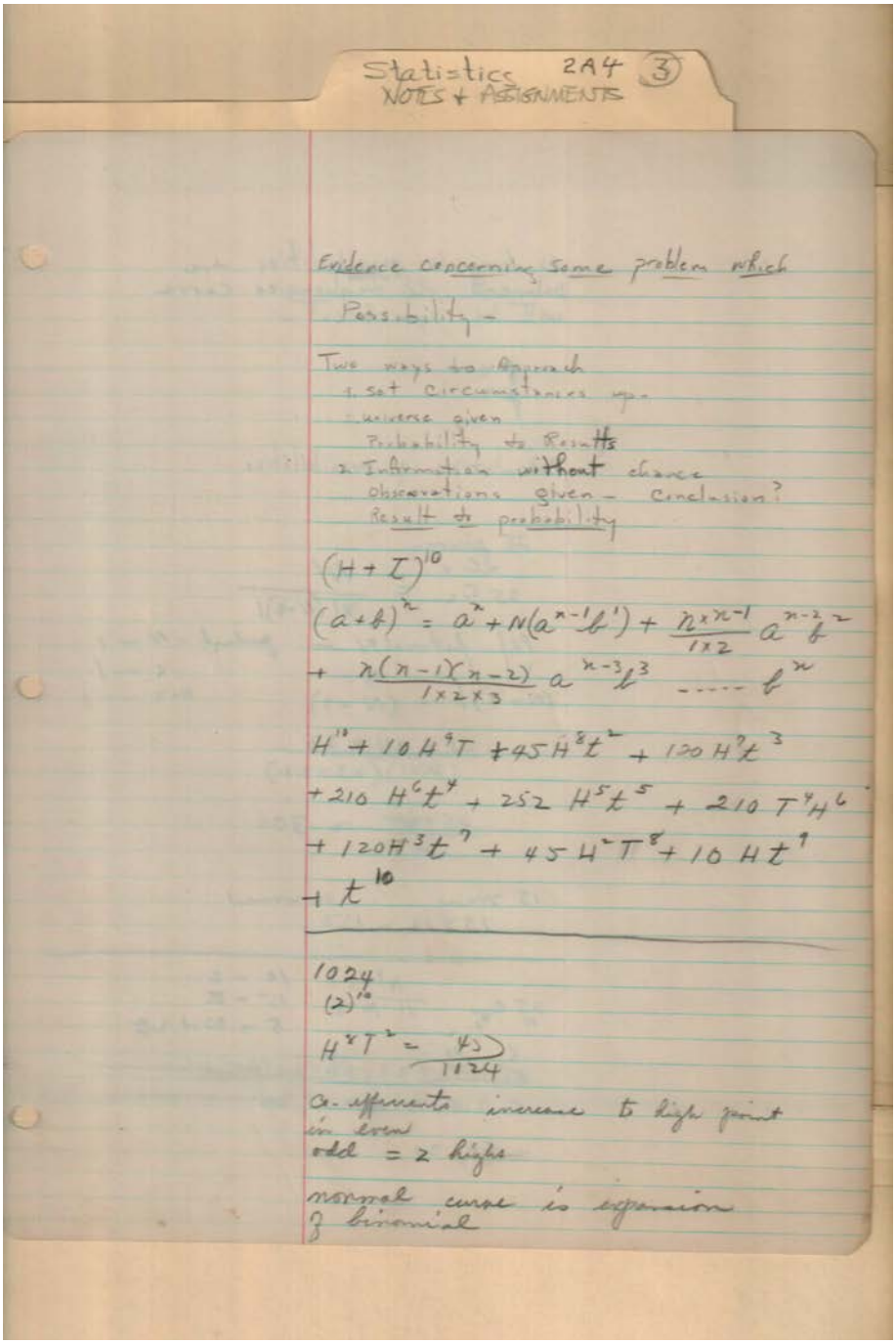

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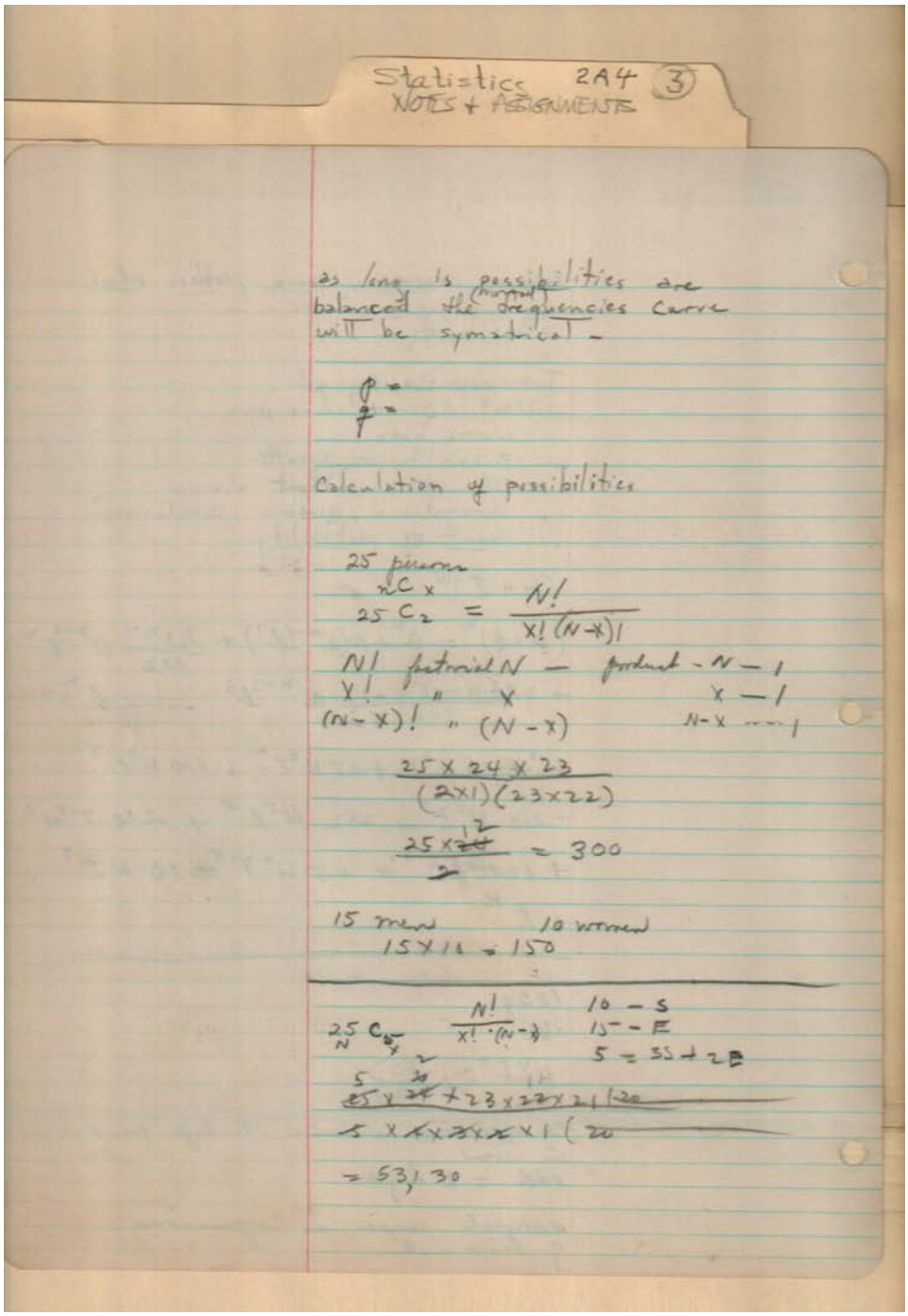

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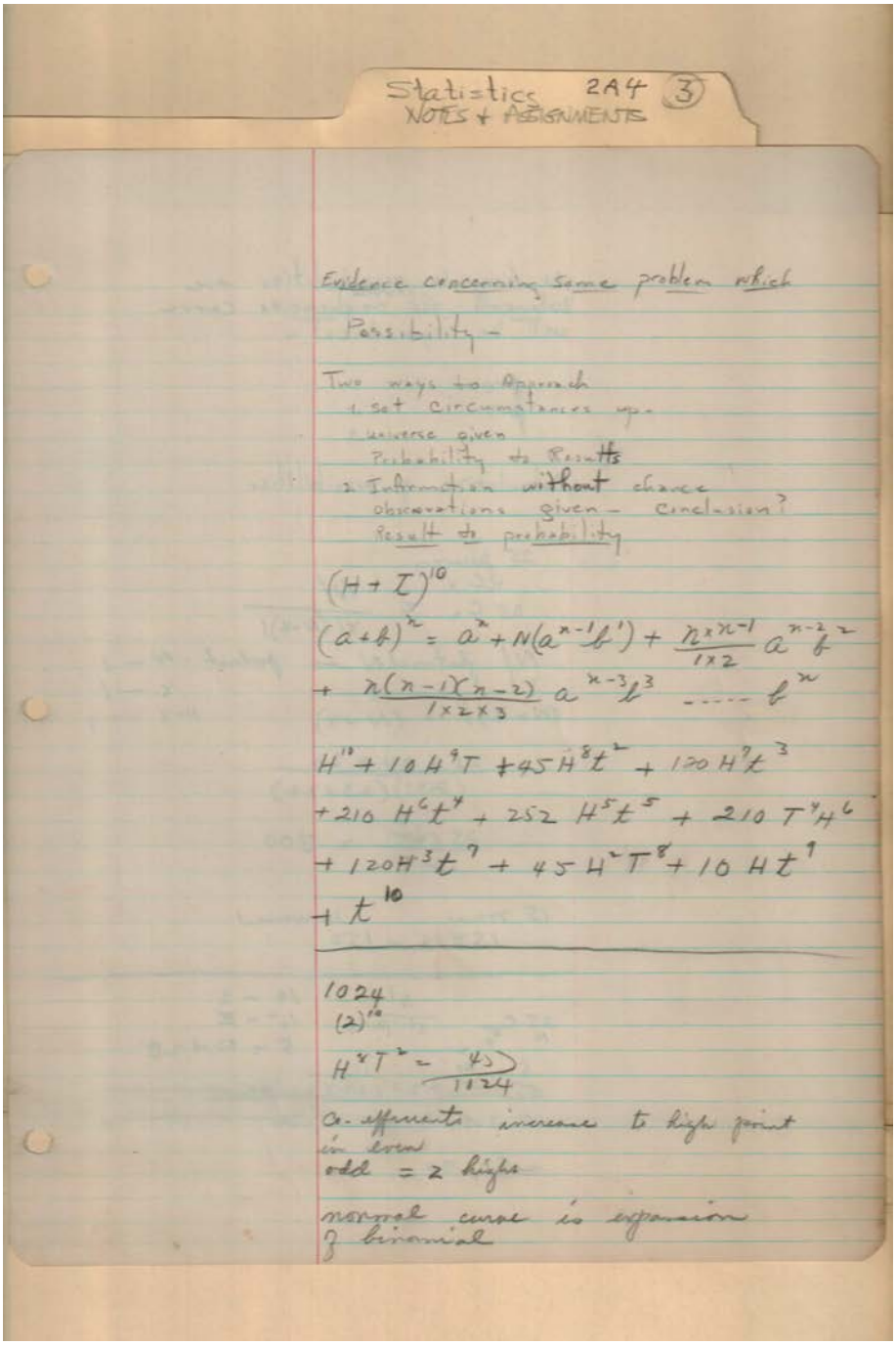

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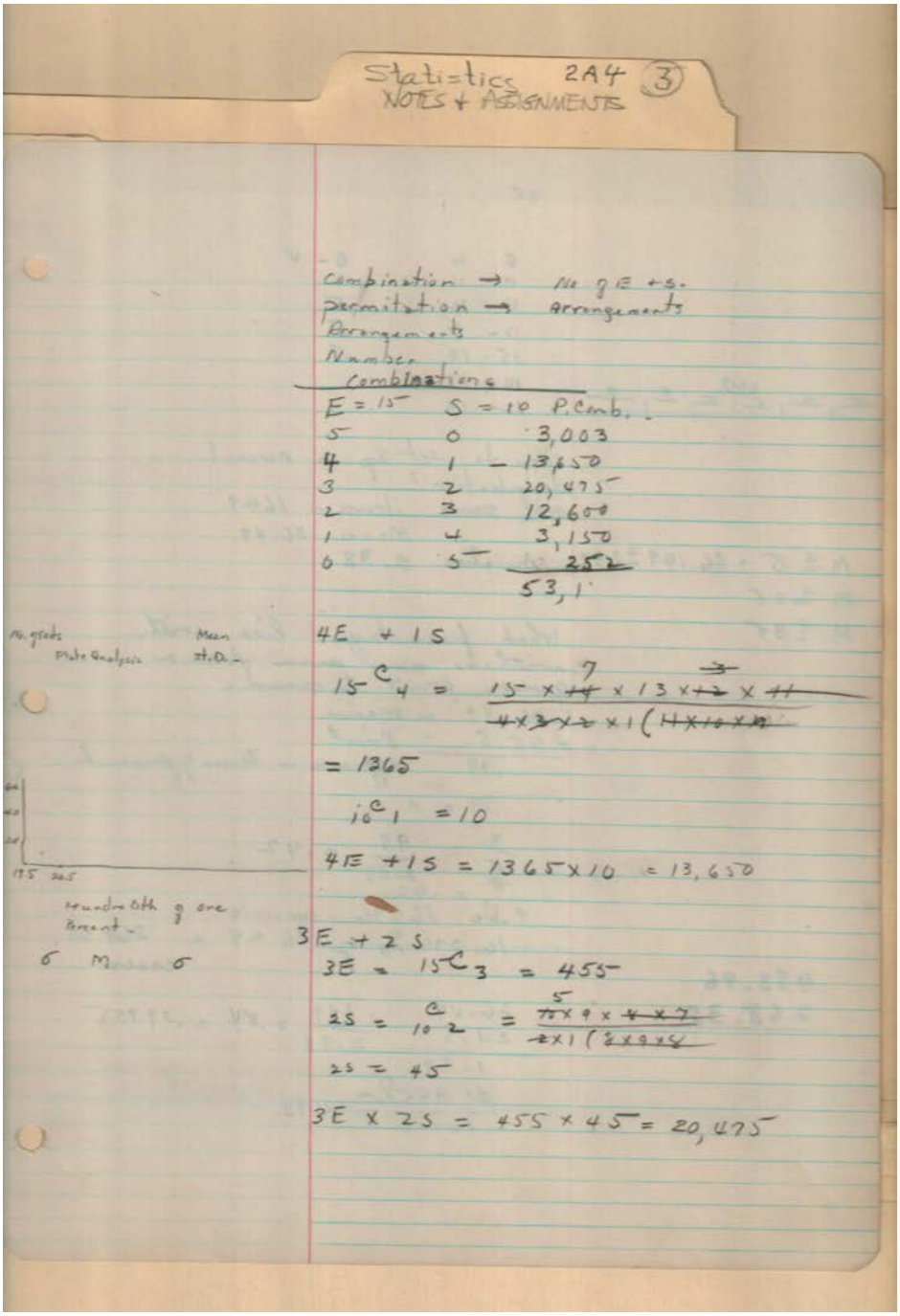

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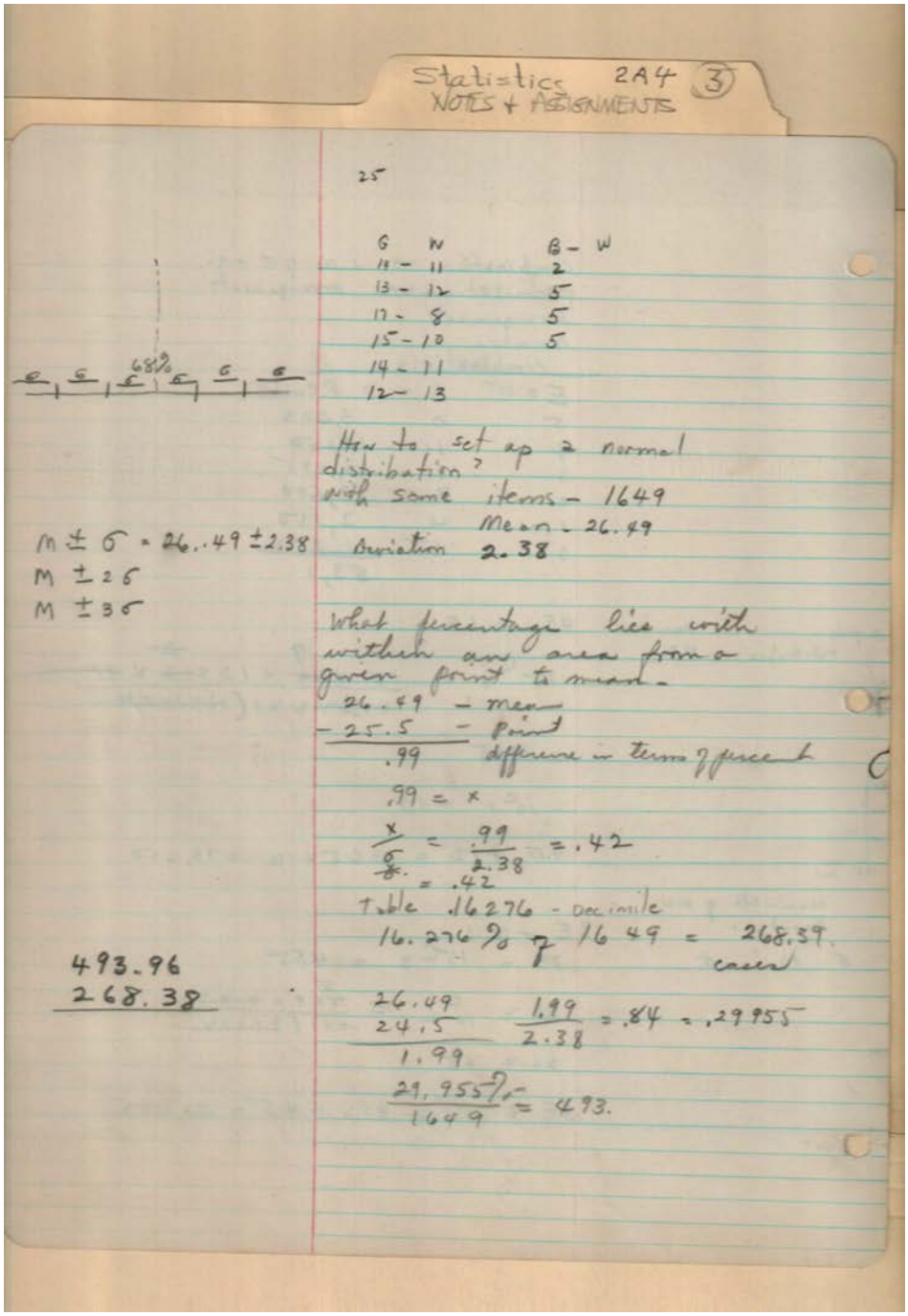

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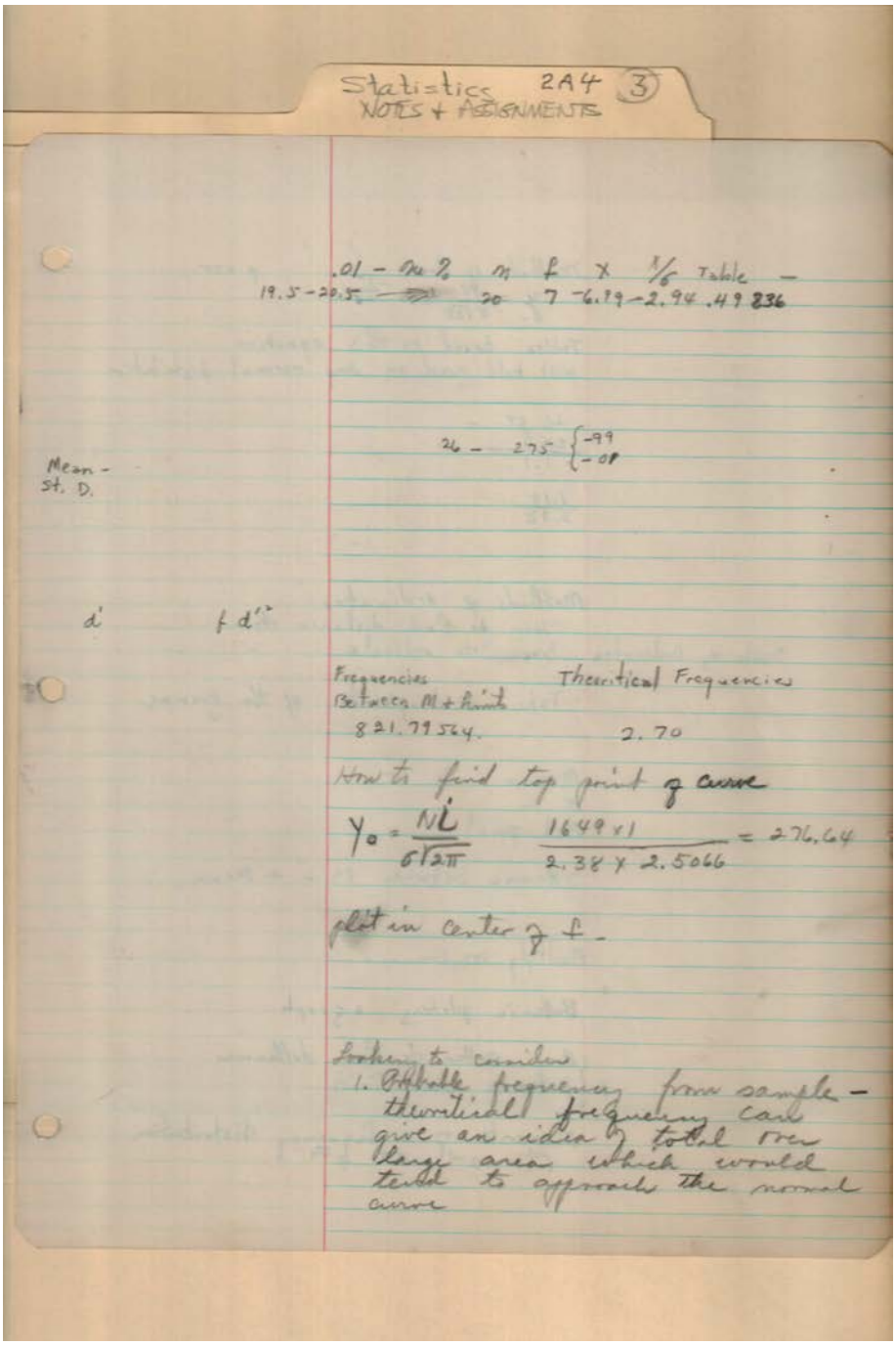

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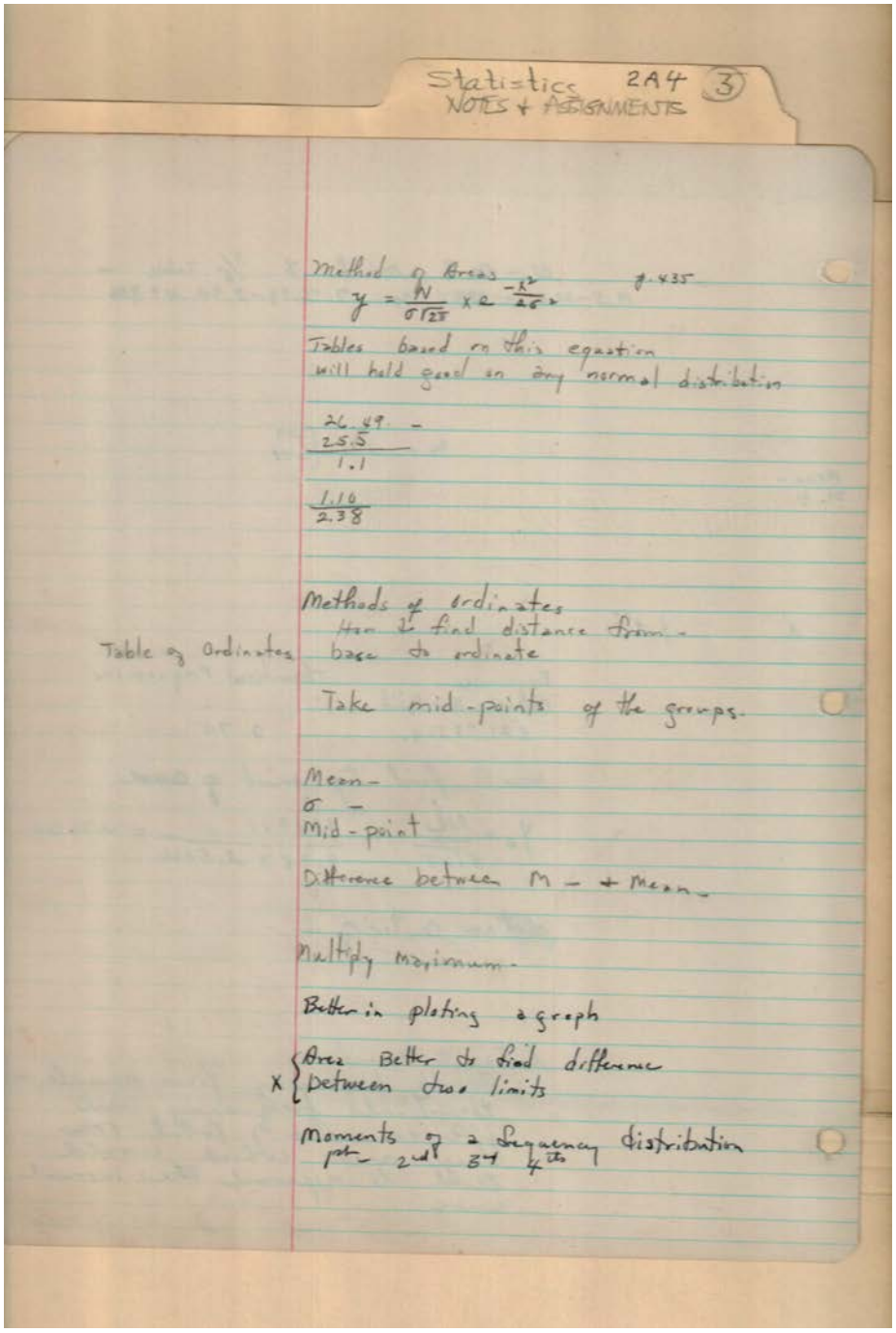

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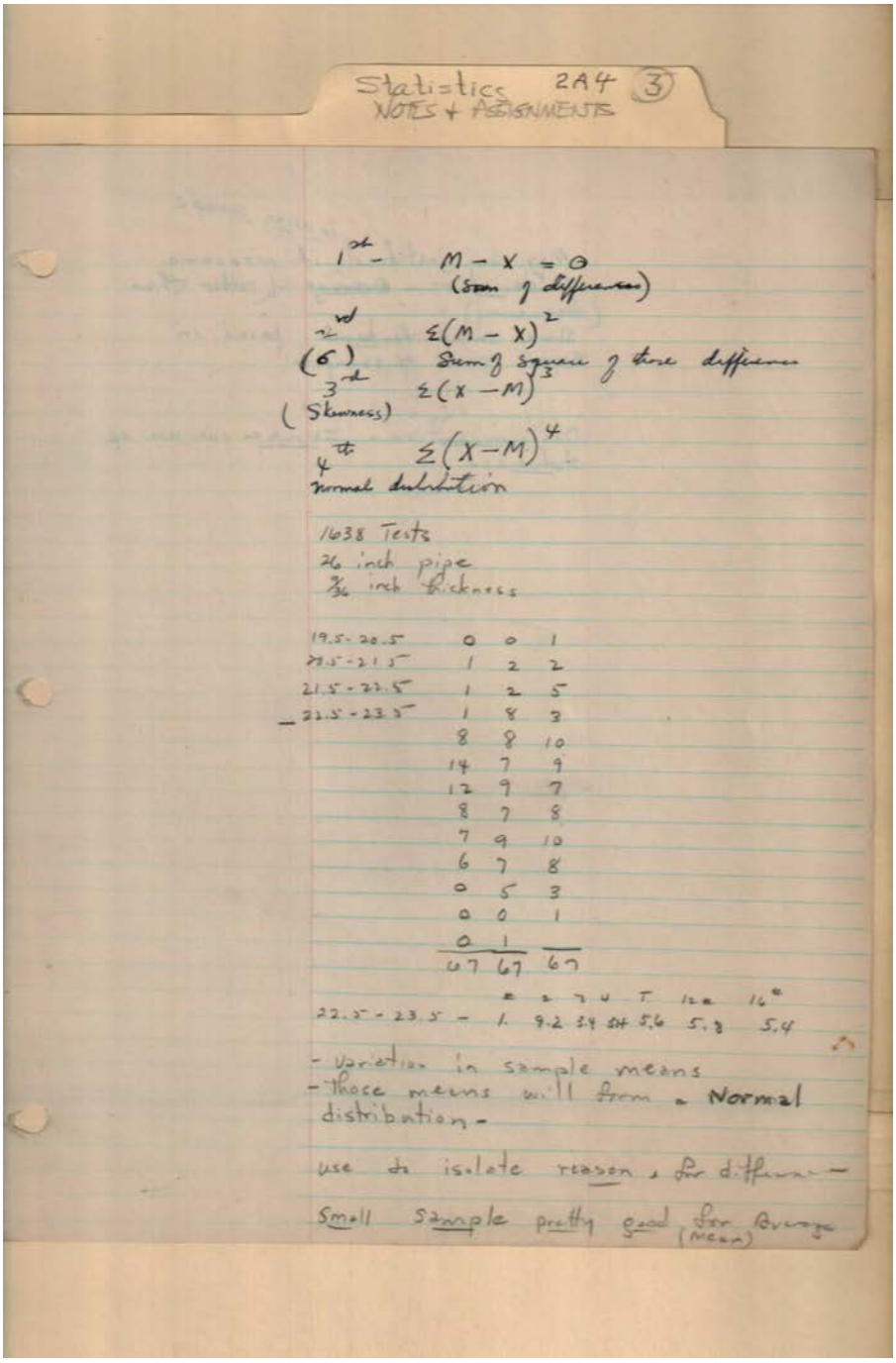

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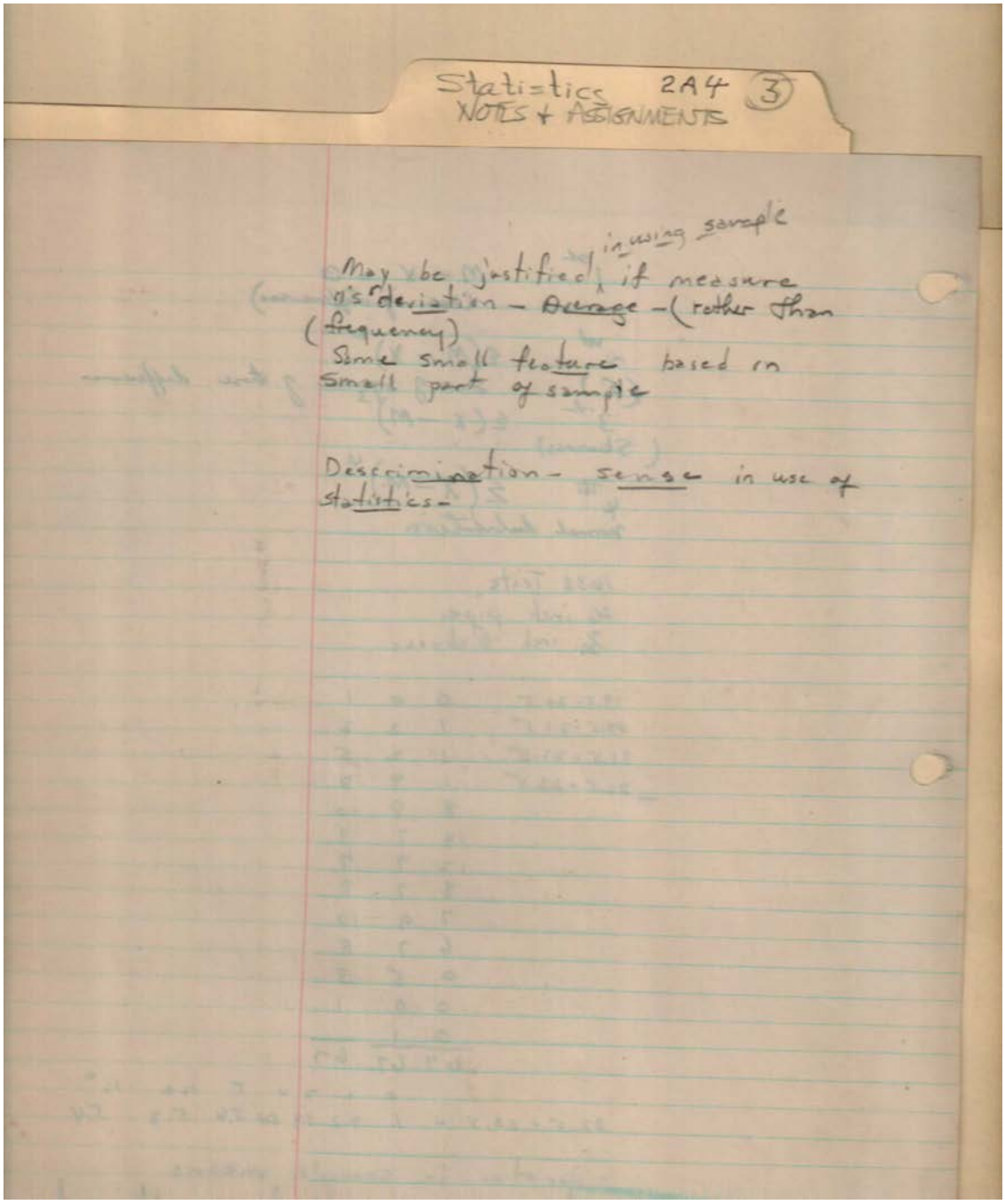
Statistical Notes

Types:
notes



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Statistical Notes

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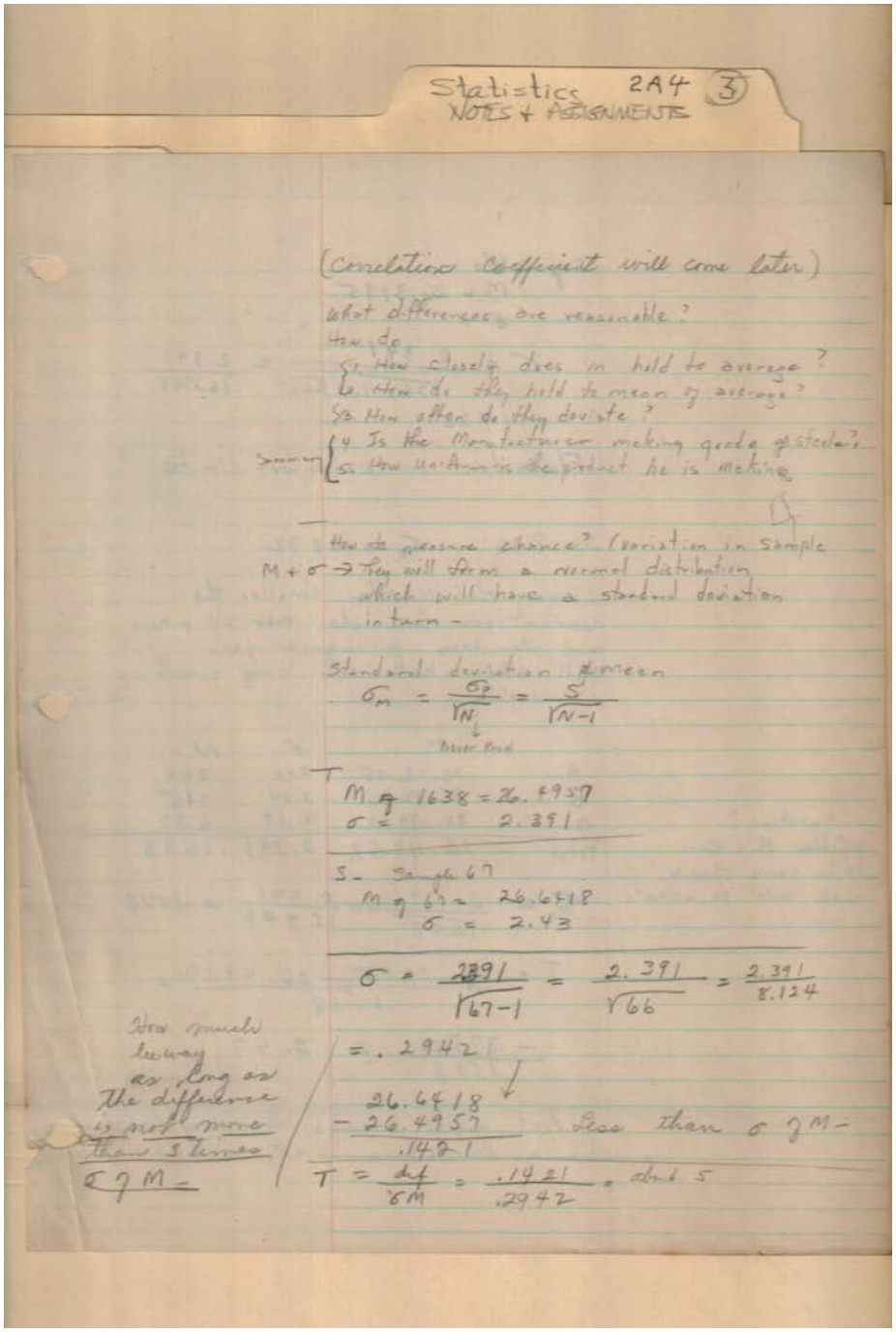
notes



Names:
Statistical Notes

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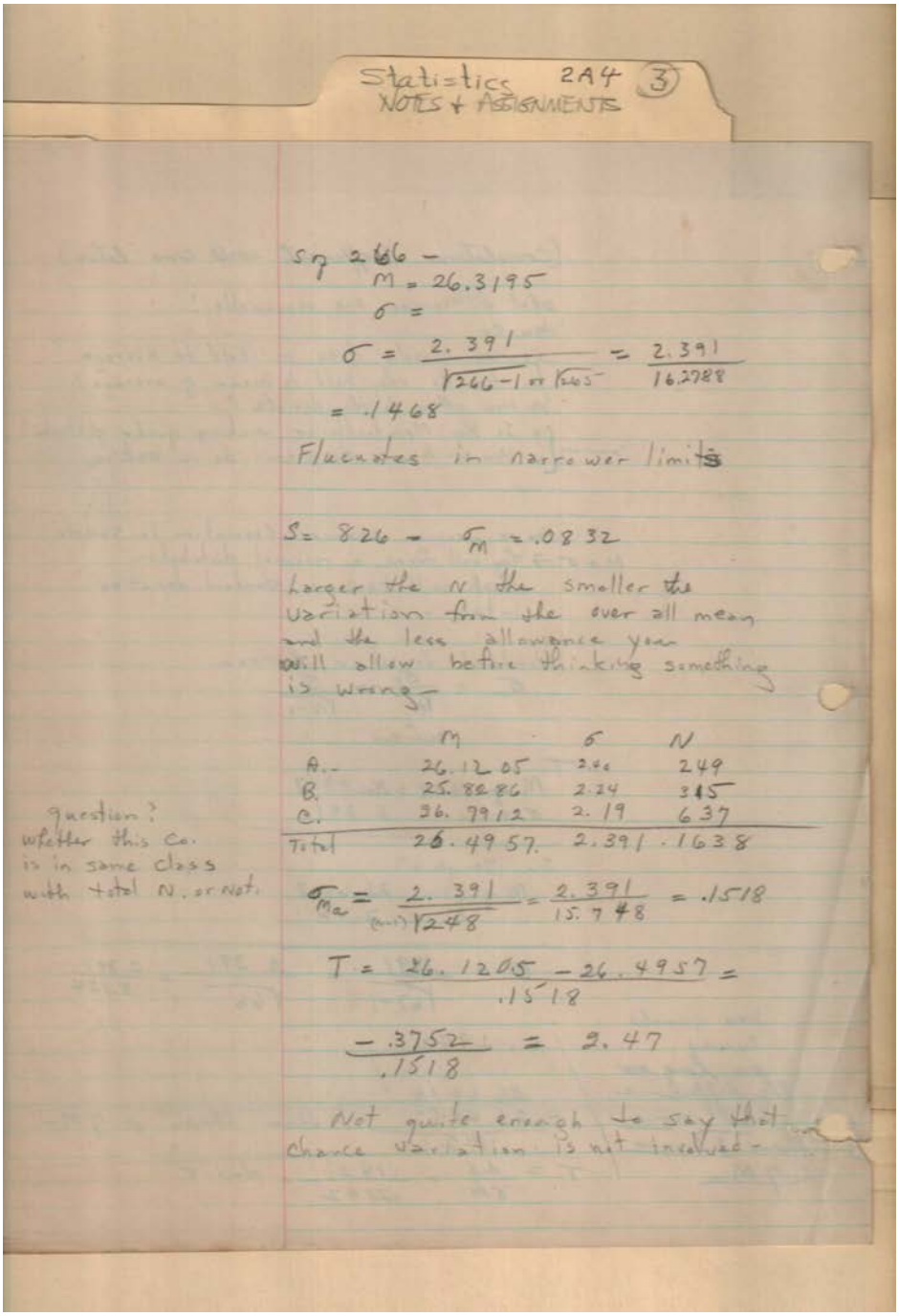
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Sp 266 -
M = 26.3195
σ =

$\sigma = \frac{2.391}{\sqrt{266-1}\text{ or }\sqrt{265}} = \frac{2.391}{16.2788}$

= .1468

Fluctuates in narrower limits

$S = 826 - \sigma_M = .0832$

Larger the N the smaller the variation from the over all mean and the less allowance you will allow before thinking something is wrong.

	M	σ	N
A.	26.1205	2.06	249
B.	25.8286	2.24	315
C.	26.7912	2.19	637
Total	26.4957	2.391	.1638

Question? Whether this Co. is in same class with total N. or not.

$\sigma_{Me} = \frac{2.391}{\sqrt{248}} = \frac{2.391}{15.748} = .1518$

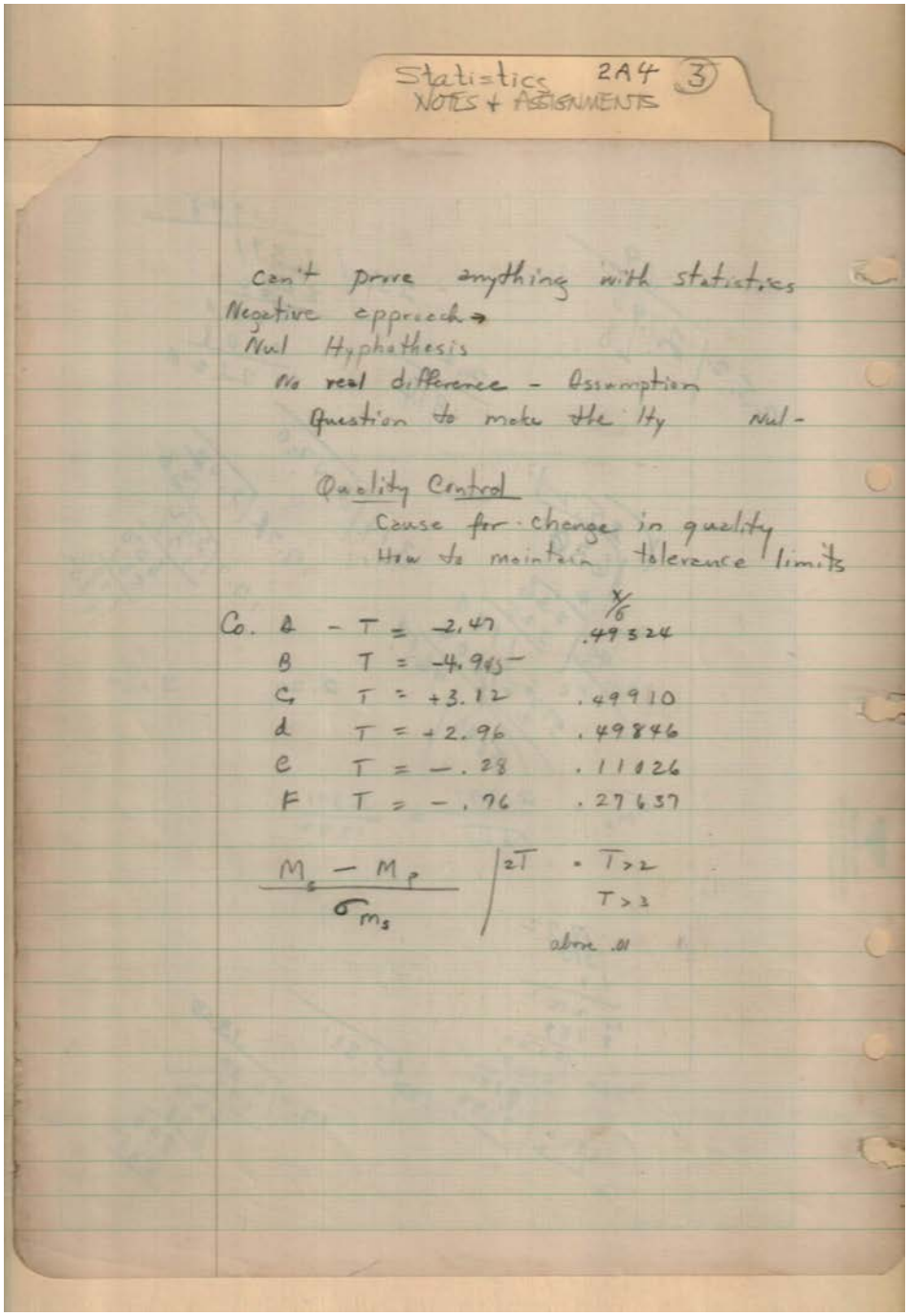
$T = \frac{26.1205 - 26.4957}{.1518} =$

$\frac{-.3752}{.1518} = 2.47$

Not quite enough to say that chance variation is not involved.

Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

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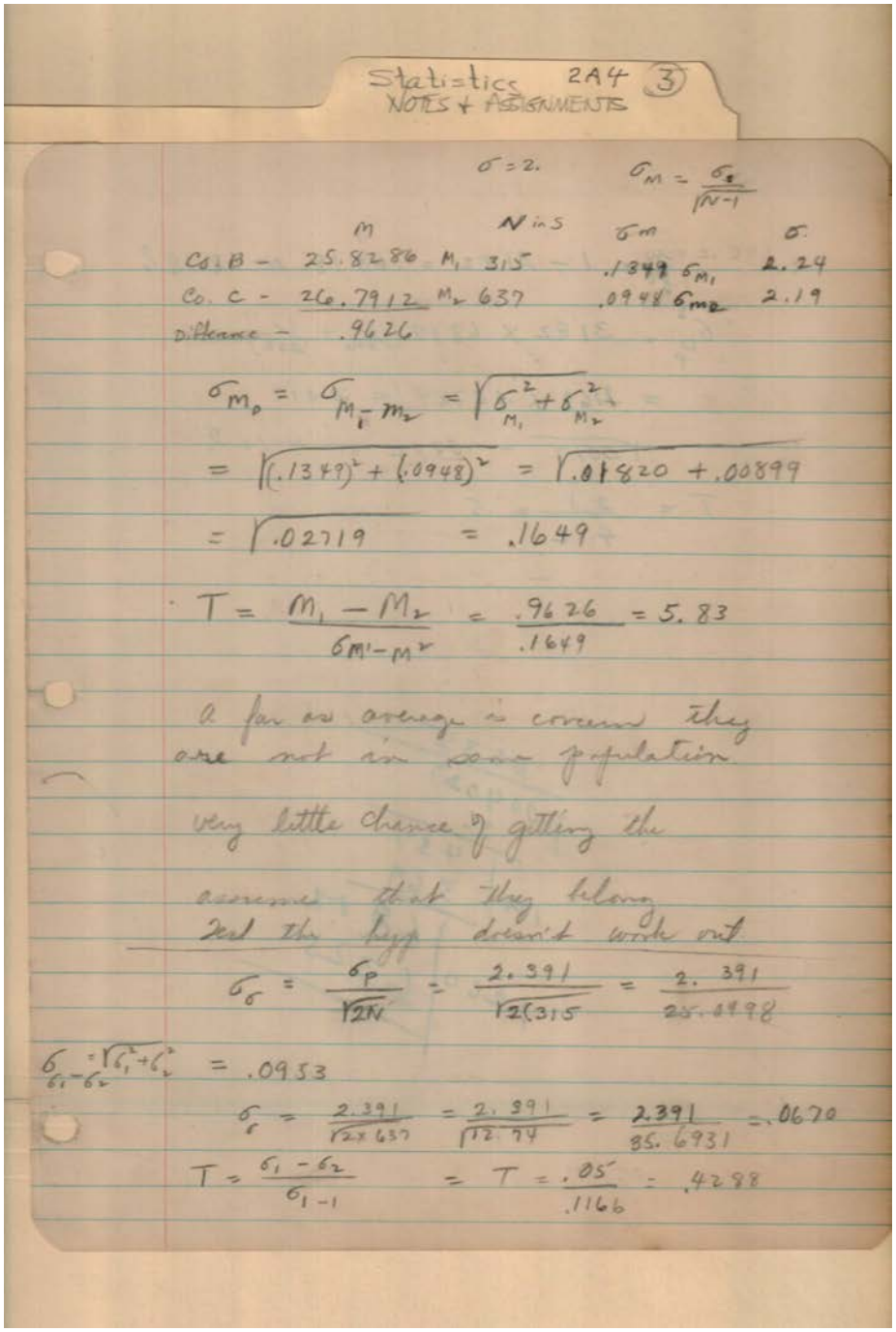
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

$\sigma = 2.$ $\sigma_M = \frac{\sigma}{\sqrt{N-1}}$

	M	N in S	σ_M	σ
Co. B -	25.8286	M_1 315	.1349 σ_{M_1}	2.24
Co. C -	26.7912	M_2 637	.0948 σ_{M_2}	2.19
Difference -	.9626			

$\sigma_{M_D} = \sigma_{M_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$

$= \sqrt{(.1349)^2 + (.0948)^2} = \sqrt{.01820 + .00899}$

$= \sqrt{.02719} = .1649$

$T = \frac{M_1 - M_2}{\sigma_{M_1 - M_2}} = \frac{.9626}{.1649} = 5.83$

As far as average is concerned they are not in same population

very little chance of getting the

assume that they belong

And the hyp doesn't work out

$\sigma_\sigma = \frac{\sigma_p}{\sqrt{2N}} = \frac{2.391}{\sqrt{2(315}} = \frac{2.391}{25.1498}$

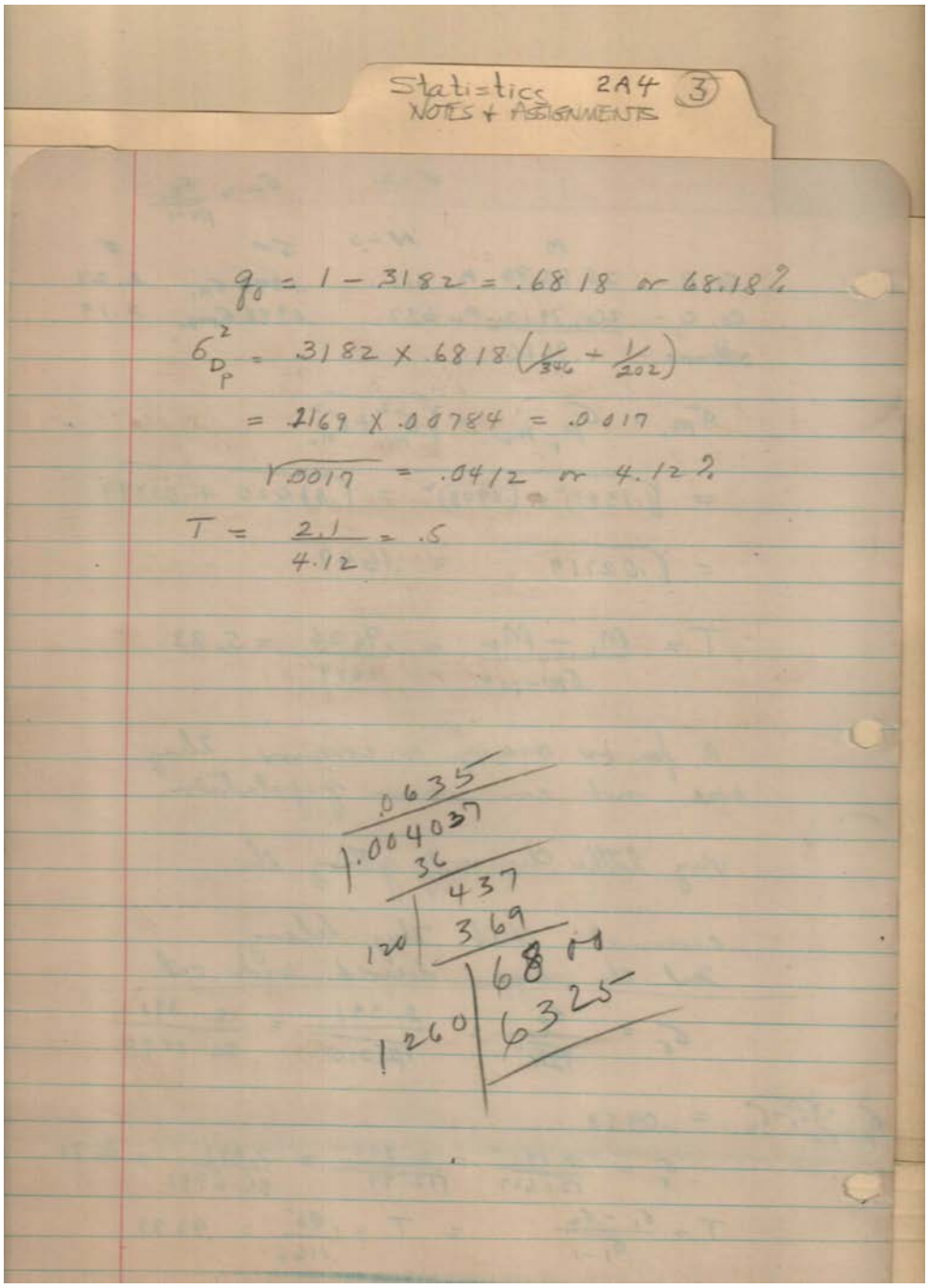
$\sigma_{\sigma_1 - \sigma_2} = \sqrt{\sigma_1^2 + \sigma_2^2} = .0953$

$\sigma_\sigma = \frac{2.391}{\sqrt{2 \times 637}} = \frac{2.391}{\sqrt{12.74}} = \frac{2.391}{35.6931} = .0670$

$T = \frac{\sigma_1 - \sigma_2}{\sigma_{1-1}} = T = \frac{.05}{.1166} = .4288$

Names:
Statistical Notes

Types:
notes



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Statistical Notes

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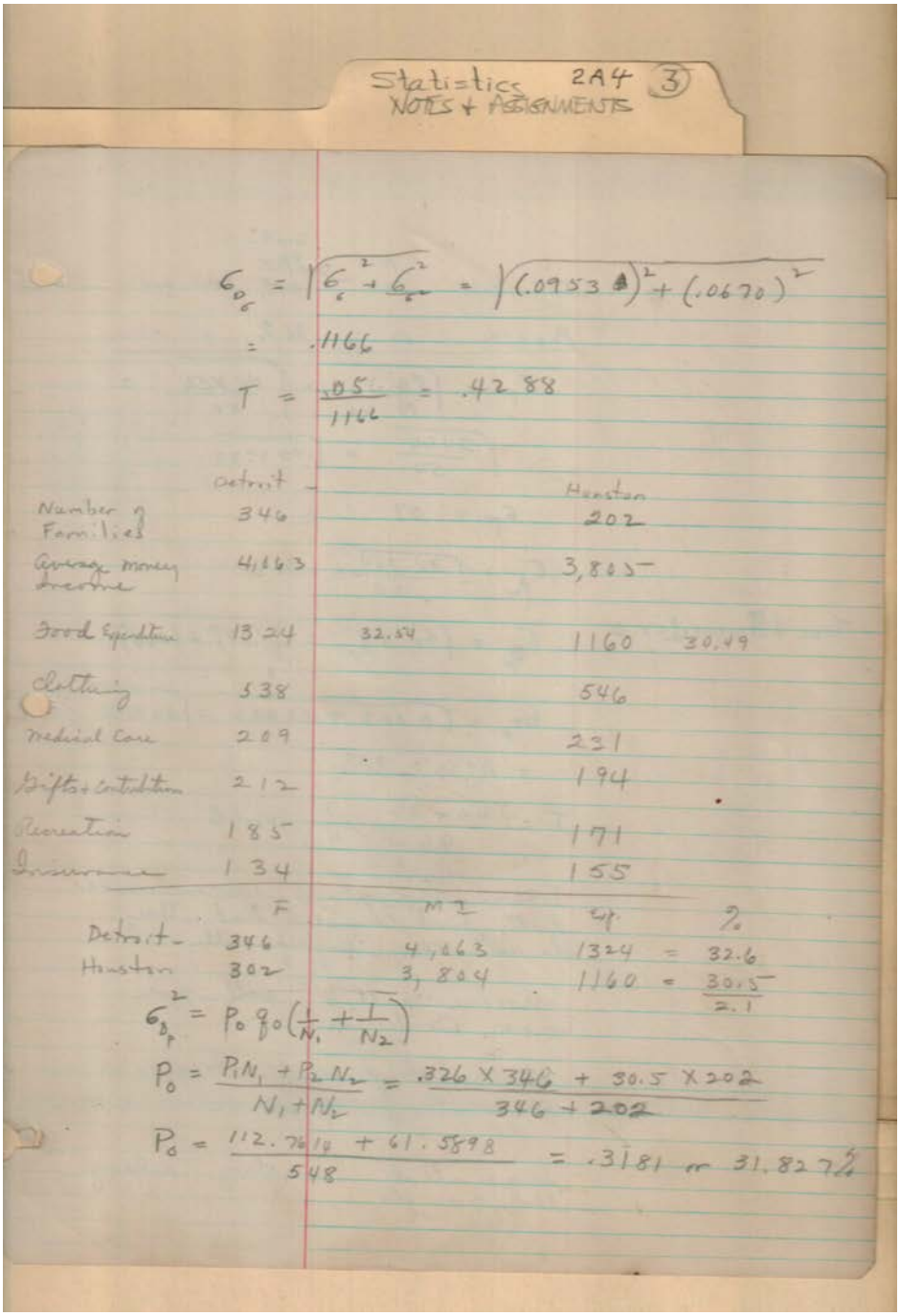
notes



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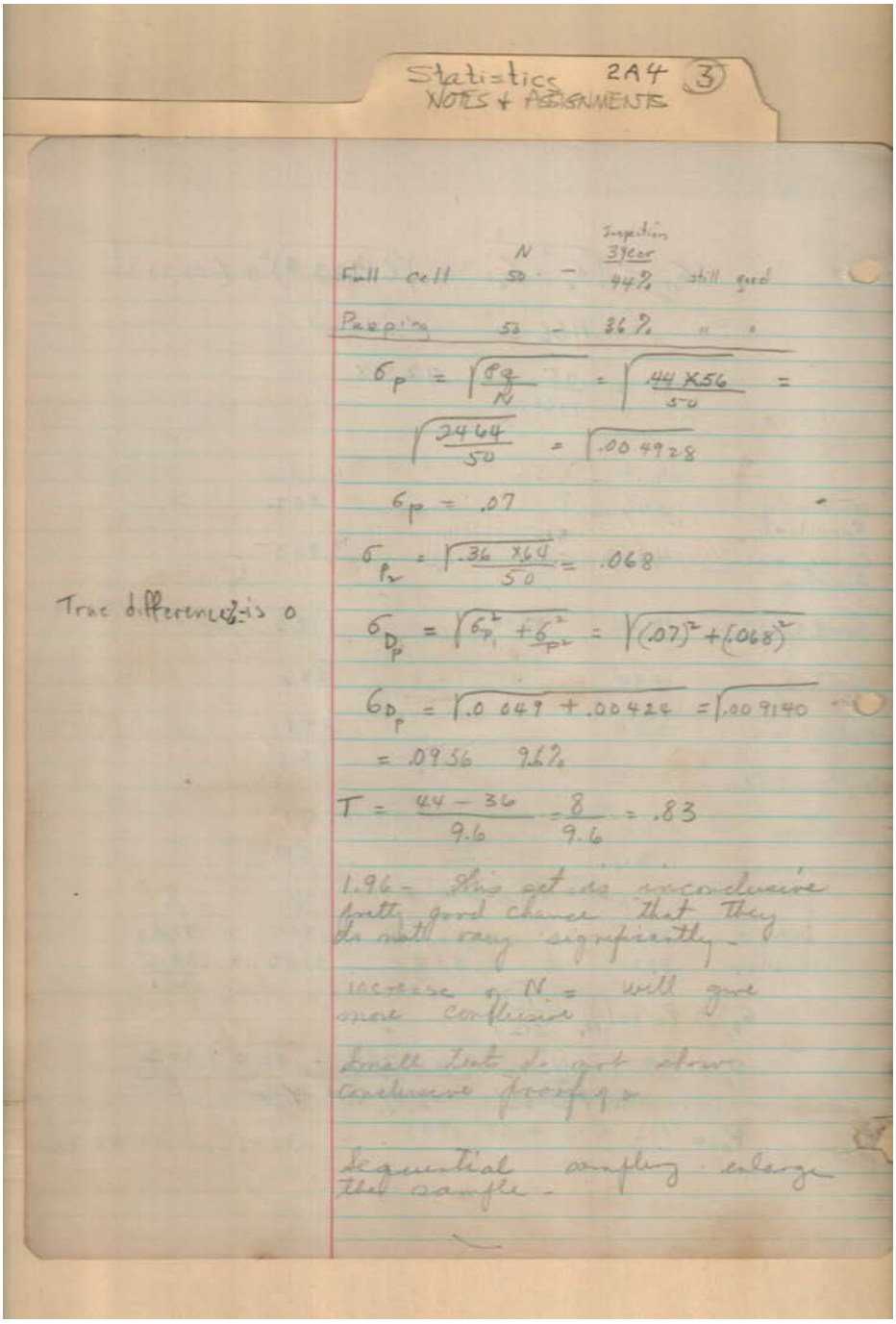
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

	N	Inspection 3 Year
Full cell	50	44% still good
Peeping	50	36% " "

$\sigma_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{.44 \times .56}{50}} = \sqrt{\frac{2464}{50}} = \sqrt{.004928}$

$\sigma_p = .07$

$\sigma_{p_2} = \sqrt{\frac{.36 \times .64}{50}} = .068$

True difference is 0

$\sigma_{D_p} = \sqrt{\sigma_{p_1}^2 + \sigma_{p_2}^2} = \sqrt{(.07)^2 + (.068)^2}$

$\sigma_{D_p} = \sqrt{.0049 + .004624} = \sqrt{.009140}$

$= .0956$ 9.6%

$T = \frac{44 - 36}{9.6} = \frac{8}{9.6} = .83$

1.96 - This set is inconclusive pretty good chance that they do not vary significantly -

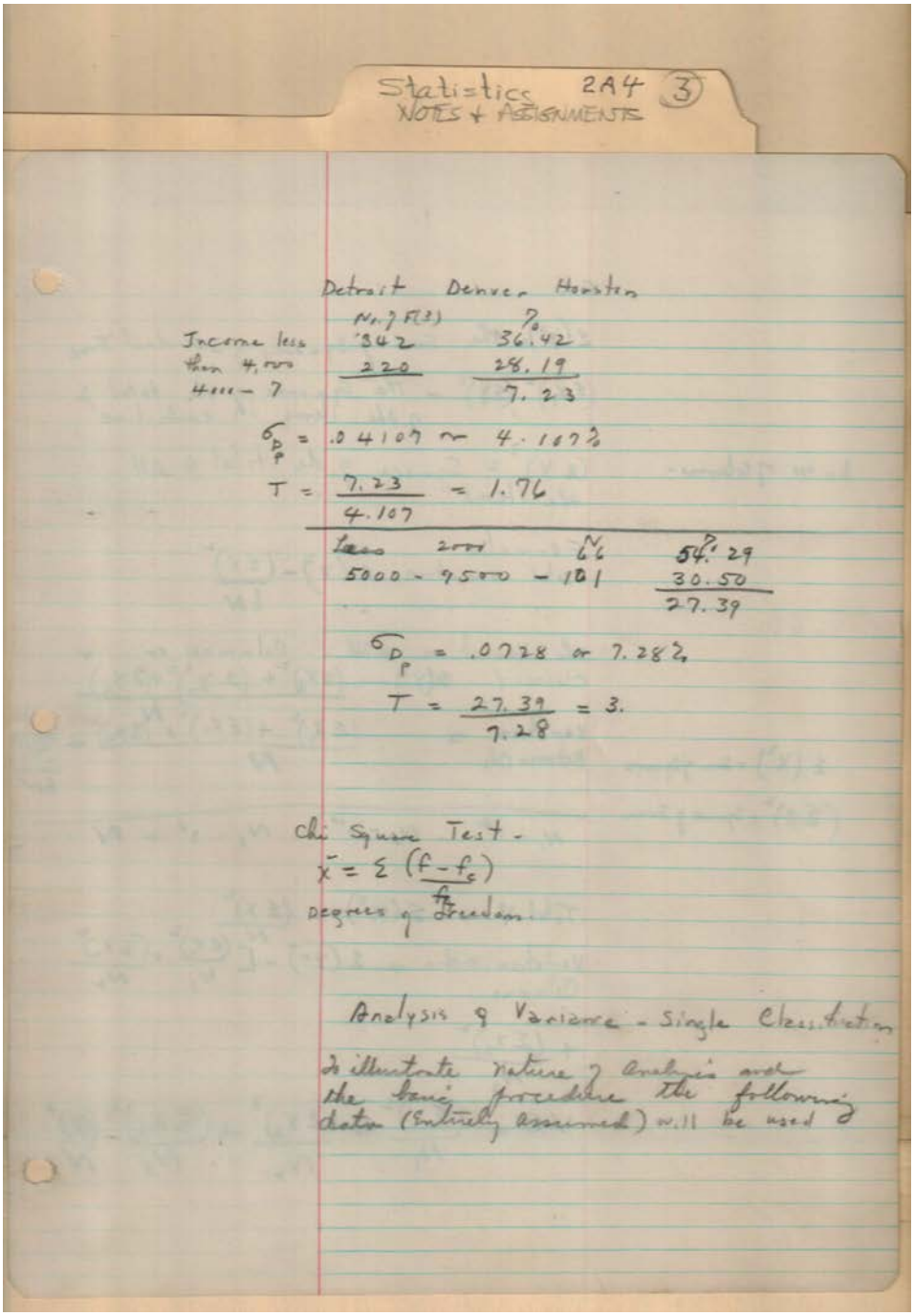
increase of N = will give more confidence

Small test do not show conclusive proof of -

Sequential sampling enlarge the sample -

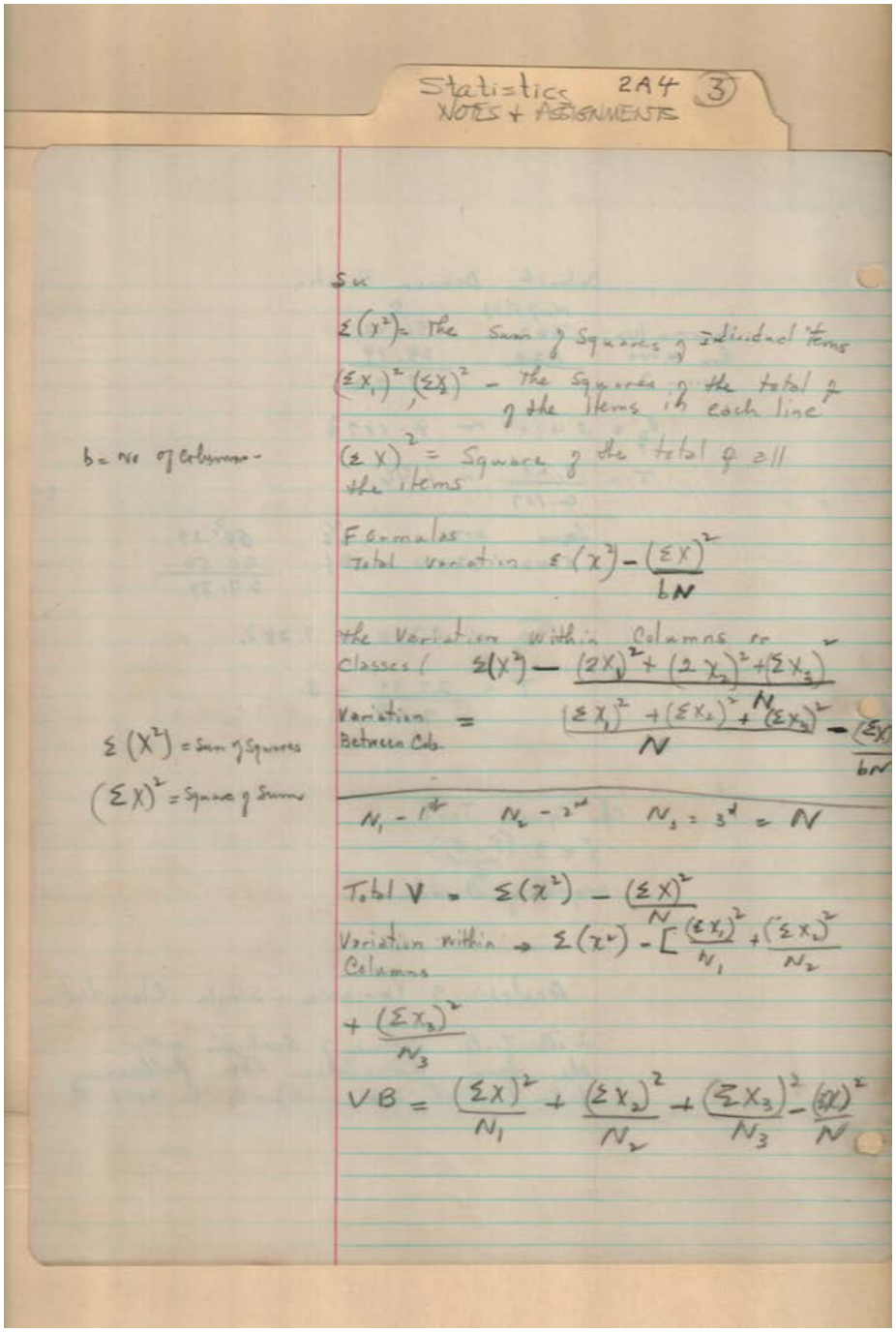
Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

Types:
notes



Names:
Statistical Notes

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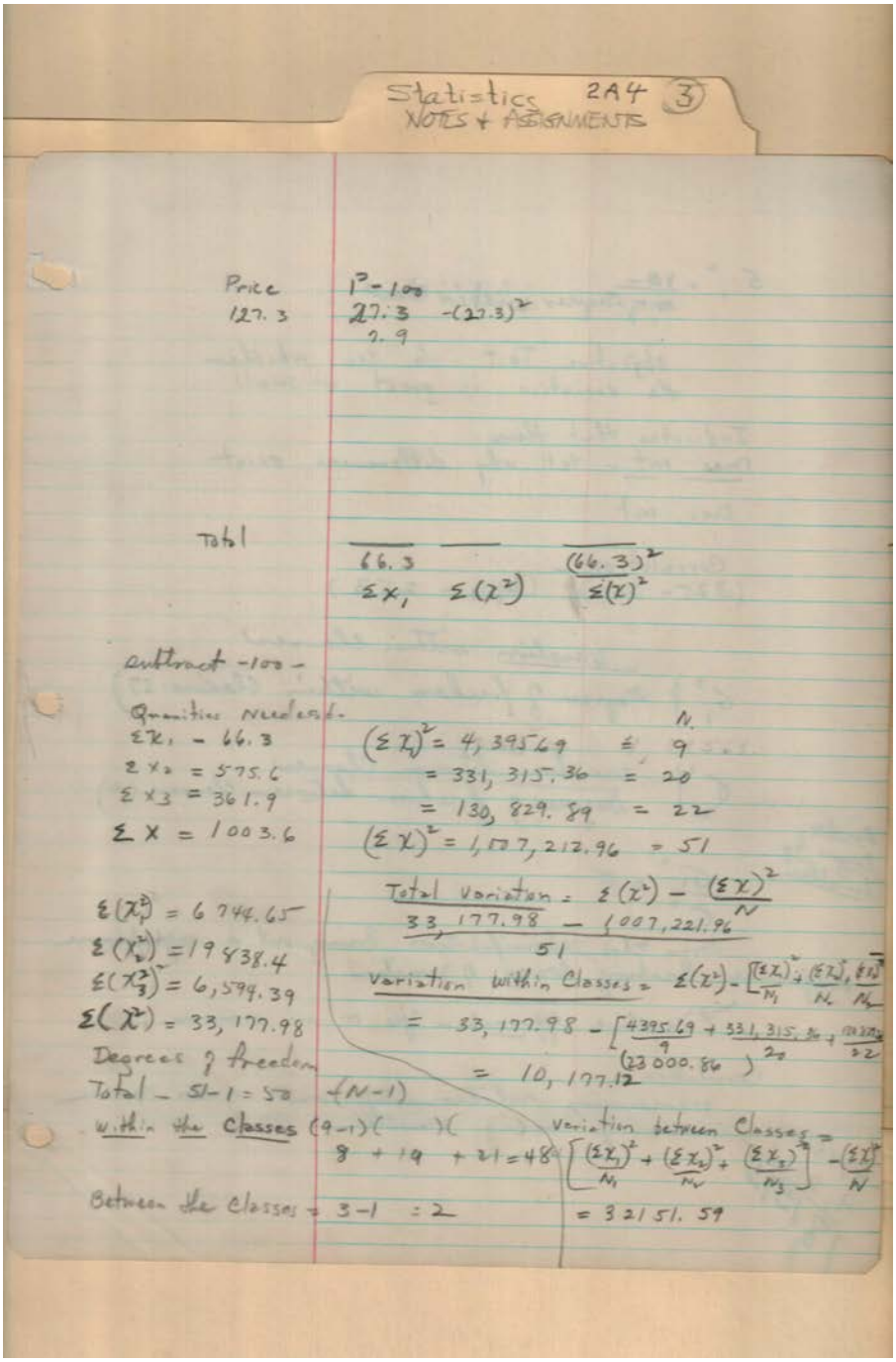
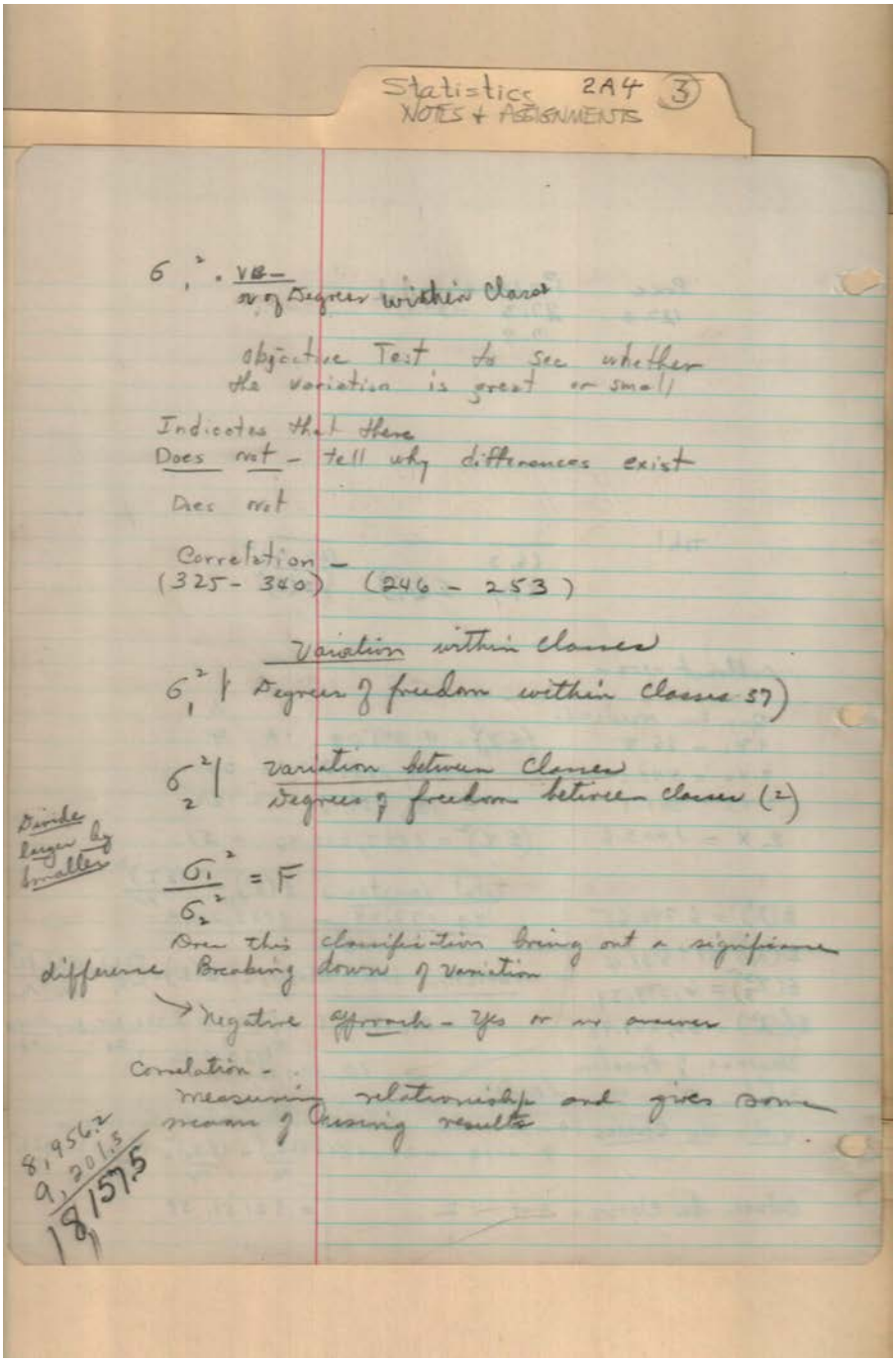
notes



Names:
Statistical Notes

Types:
notes



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Statistical Notes

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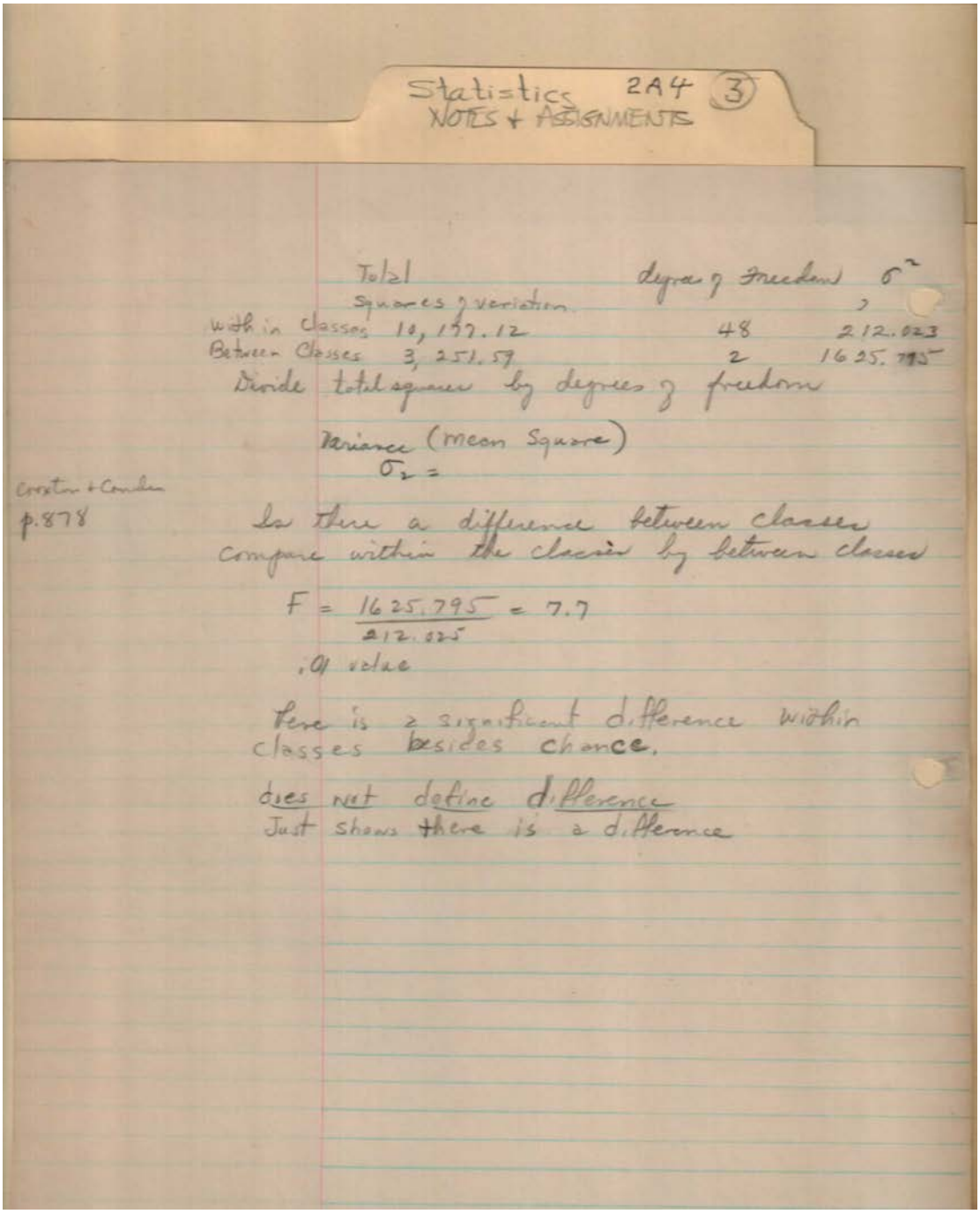
notes



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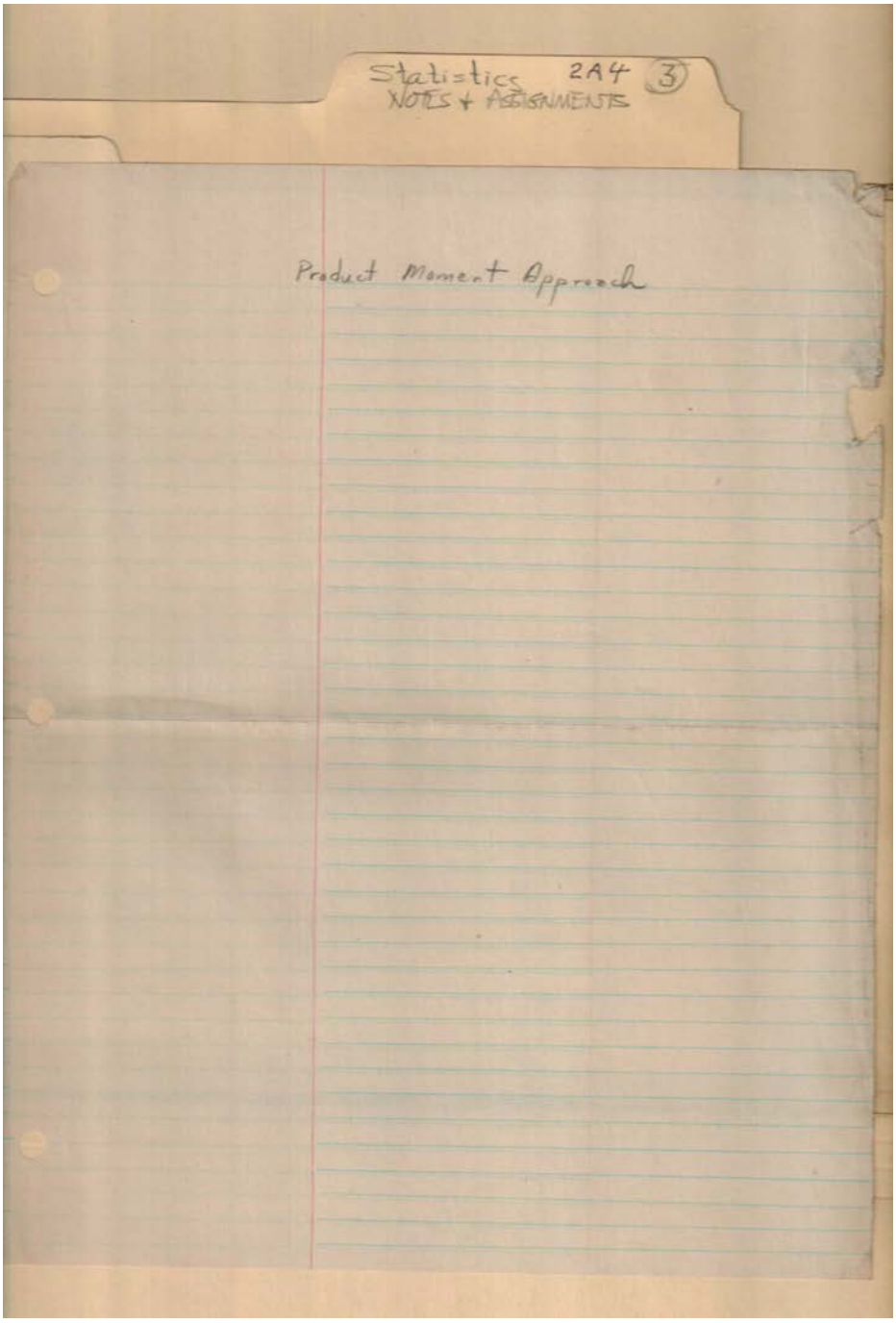
notes



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Statistical Notes

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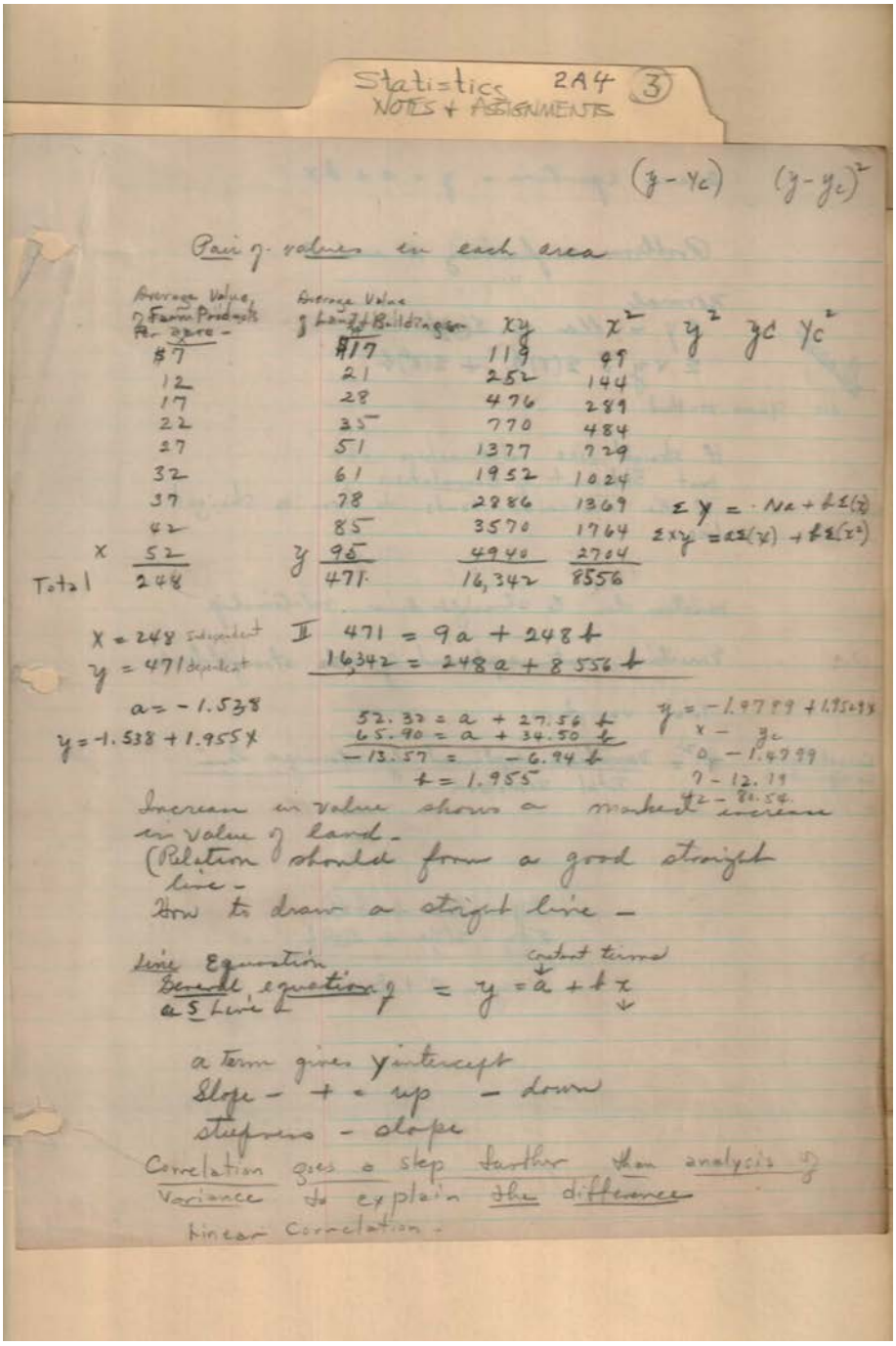
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

$(y-y_c)$ $(y-y_c)^2$

Pair y values in each area

Average Value of Farm Products Per Acre - x	Average Value of Land & Buildings y	xy	x^2	y^2	yc	y_c^2
$17	$17	119	49			
12	21	252	144			
17	28	476	289			
22	35	770	484			
27	51	1377	729			
32	61	1952	1024			
37	78	2886	1369			
42	85	3570	1764			
x 52	y 95	4940	2704			
Total 248		16,342	8556			

$\Sigma y = Na + b\Sigma(x)$
$\Sigma xy = a\Sigma(x) + b\Sigma(x^2)$

$\bar{x} = 248$ independent
$\bar{y} = 471$ dependent

II $471 = 9a + 248b$
$16342 = 248a + 8556b$

$a = -1.538$
$y = -1.538 + 1.955x$

$52.33 = a + 27.56b$
$65.90 = a + 34.50b$
$-13.57 = -6.94b$
$b = 1.955$

$y = -1.4799 + 1.9549x$
$x - \bar{x}$
$a - 1.4799$
$\bar{y} - 12.19$
$\Sigma^2 - 80.54$

Increase in value shows a market increase in value of land.
(Relation should form a good straight line.
How to draw a straight line -

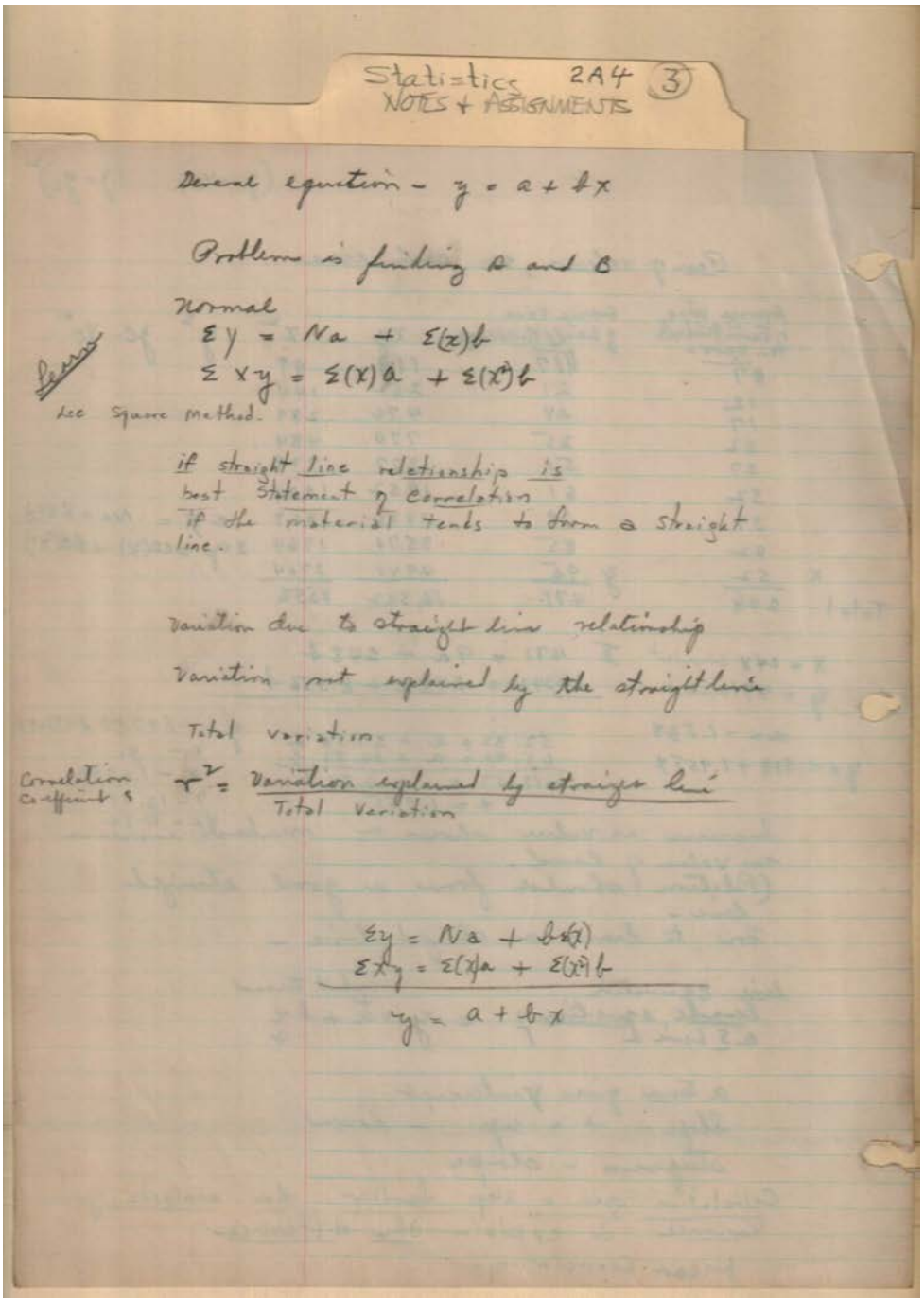
Line Equation
Should equation of a Straight Line $y = y = a + bx$ (a = constant terms)

a term gives y intercept
Slope - + = up - down
steepness - slope

Correlation goes a step further than analysis of Variance to explain the difference
linear Correlation -

Names:
Statistical Notes

Types:
notes



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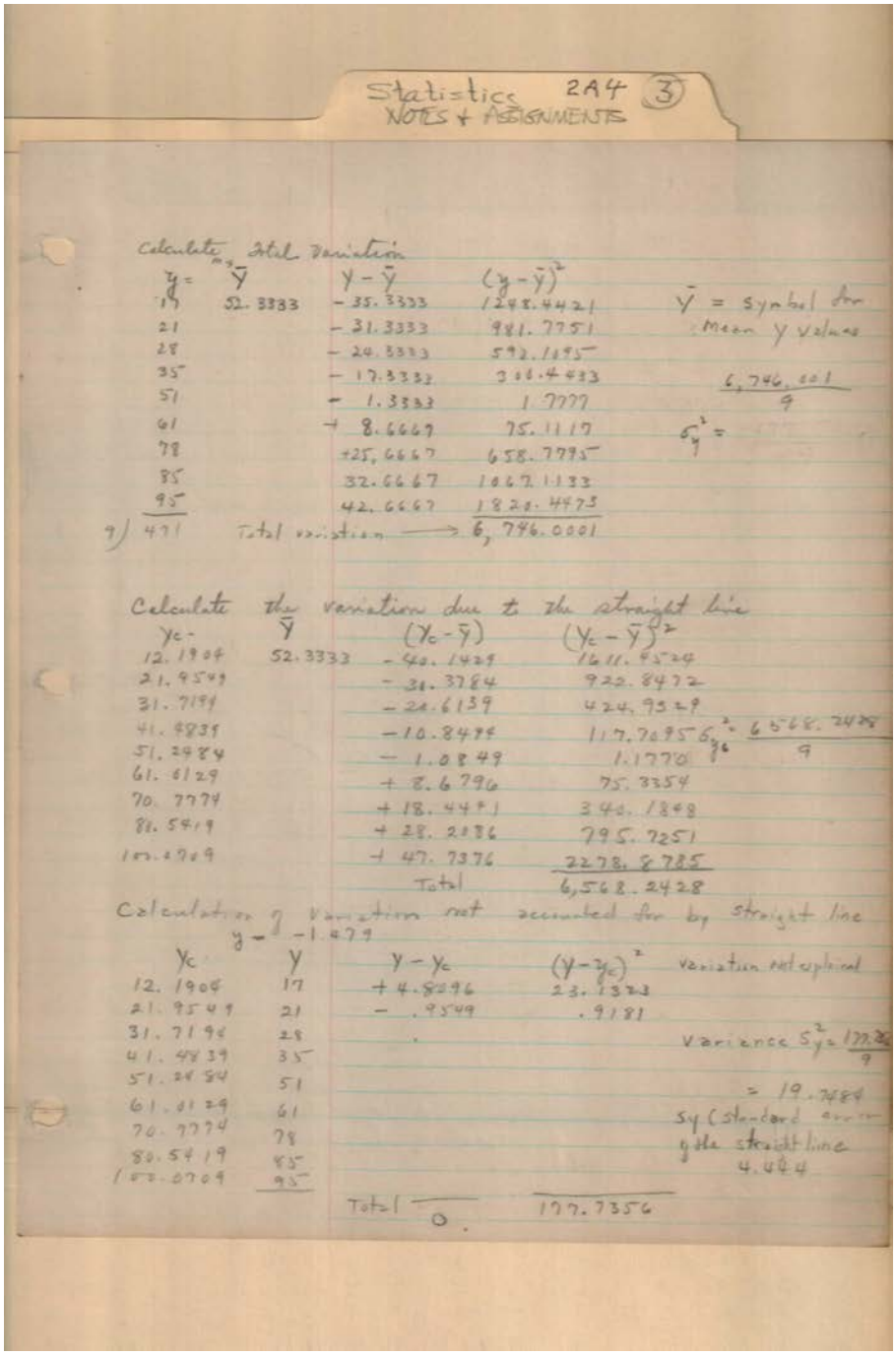

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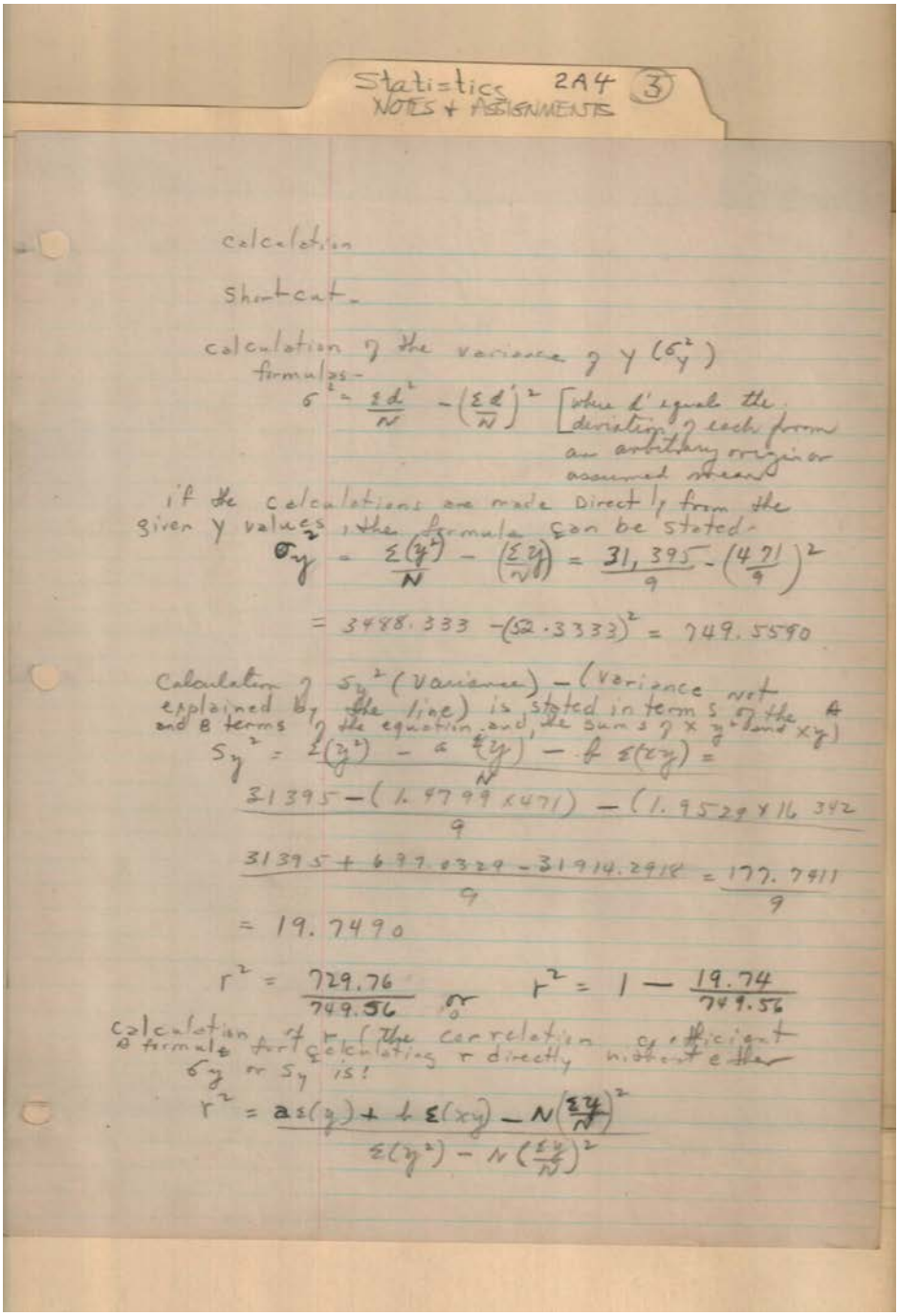


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

calculation

Shortcut.

calculation of the variance of Y (σ_y^2)
formulas-

$\sigma^2 = \frac{\Sigma d^2}{N} - \left(\frac{\Sigma d}{N}\right)^2$ [where d' equal the deviation of each from an arbitrary origin or assumed mean]

if the calculations are made directly from the given y values, the formula can be stated-

$\sigma_y^2 = \frac{\Sigma(y^2)}{N} - \left(\frac{\Sigma y}{N}\right) = \frac{31,395}{9} - \left(\frac{471}{9}\right)^2$

$= 3488.333 - (52.3333)^2 = 749.5590$

Calculation of s_y^2 (variance) - (variance not explained by the line) is stated in terms of the A and B terms of the equation, and the sums of x y and xy)

$s_y^2 = \frac{\Sigma(y^2) - a\Sigma(y) - b\Sigma(xy)}{N} =$

$\frac{31395 - (1.99799 \times 471) - (1.9529 \times 16342}{9}$

$\frac{31395 + 699.0329 - 31914.2918}{9} = \frac{177.7411}{9}$

$= 19.7490$

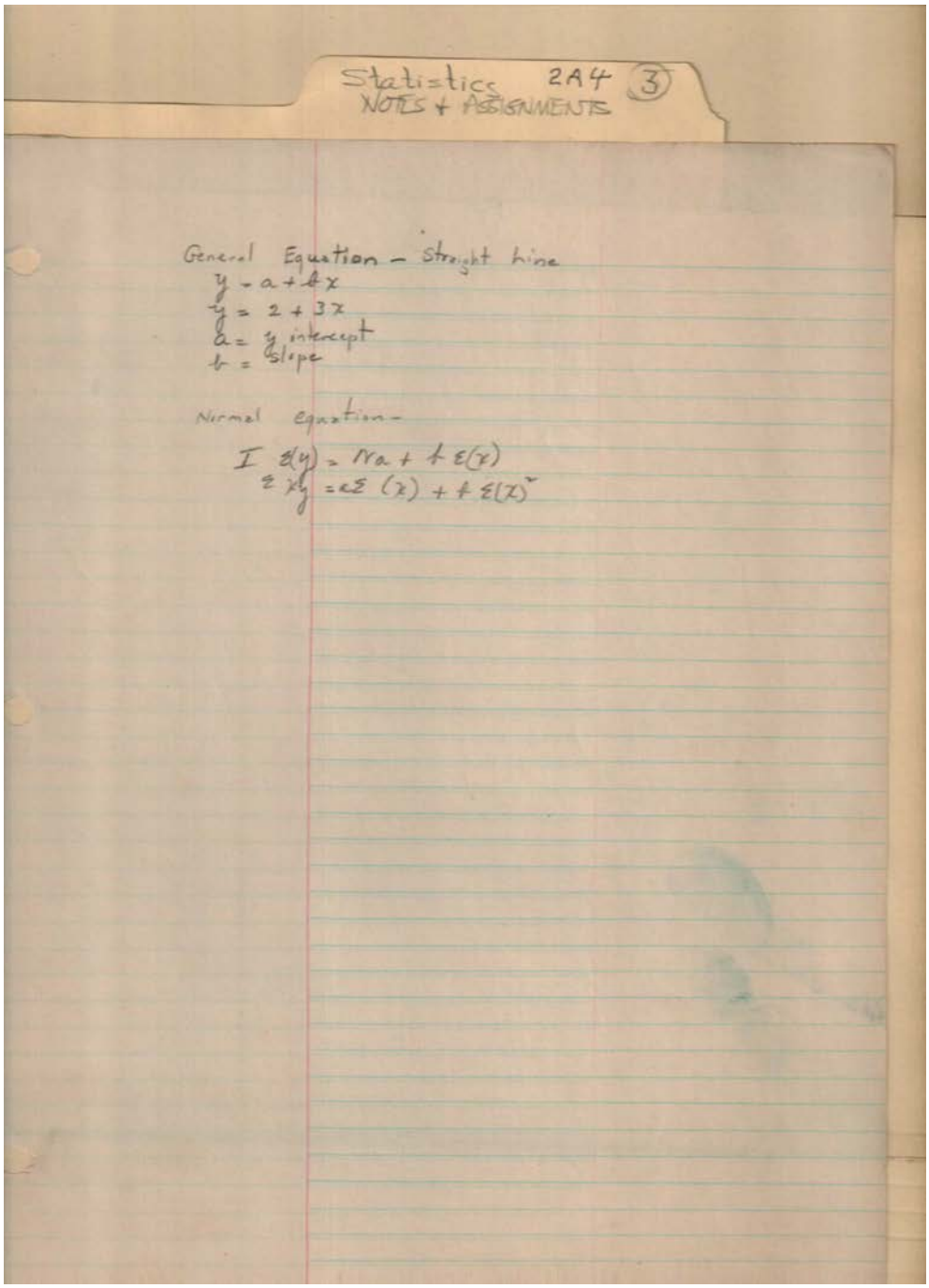
$r^2 = \frac{729.76}{749.56}$ or $r^2 = 1 - \frac{19.74}{749.56}$

calculation of r (the correlation coefficient
formula for calculating r directly without either
σ_y or s_y is!

$r^2 = \frac{a\Sigma(y) + b\Sigma(xy) - N\left(\frac{\Sigma y}{N}\right)^2}{\Sigma(y^2) - N\left(\frac{\Sigma y}{N}\right)^2}$

Names:
Statistical Notes

Types:
notes



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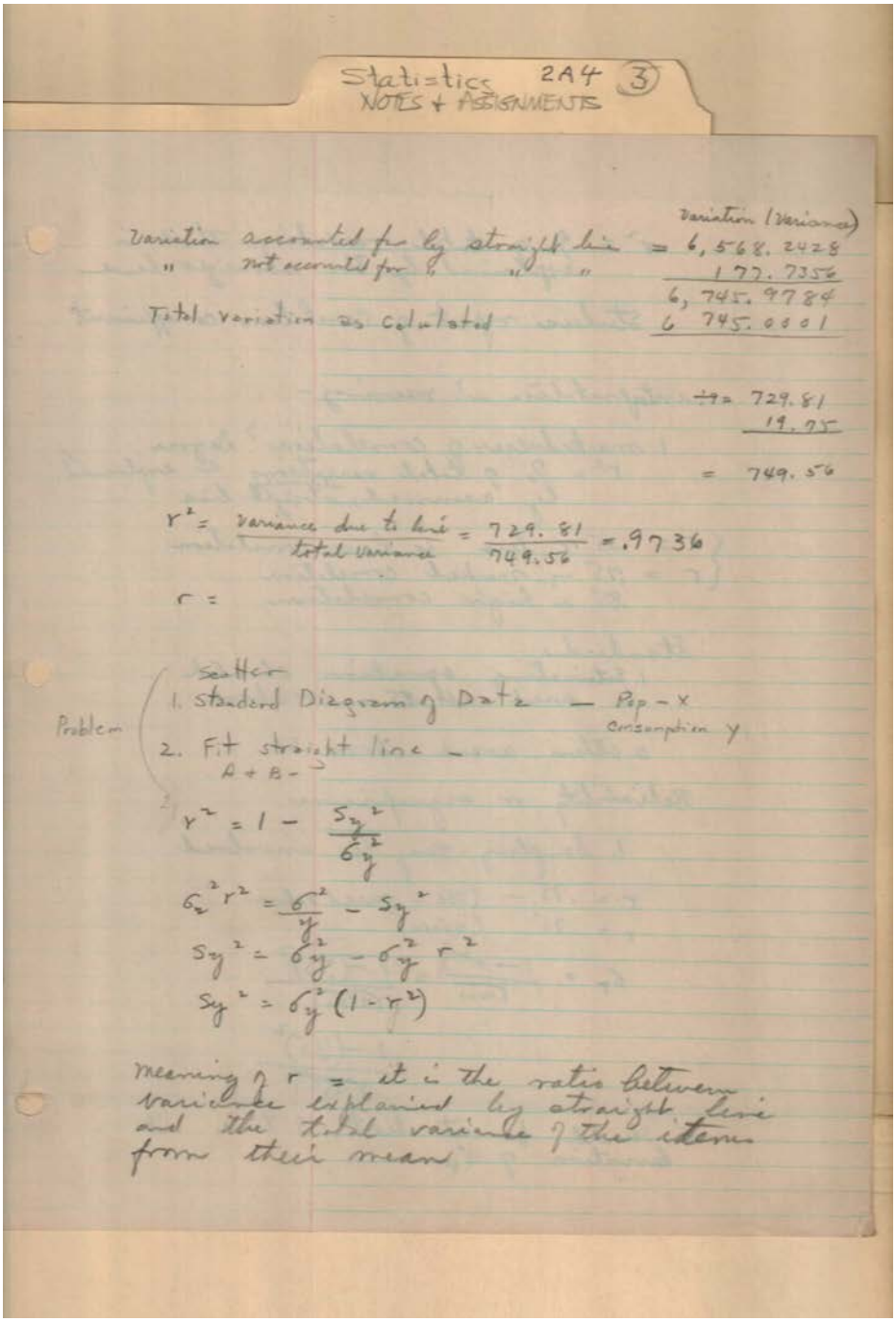

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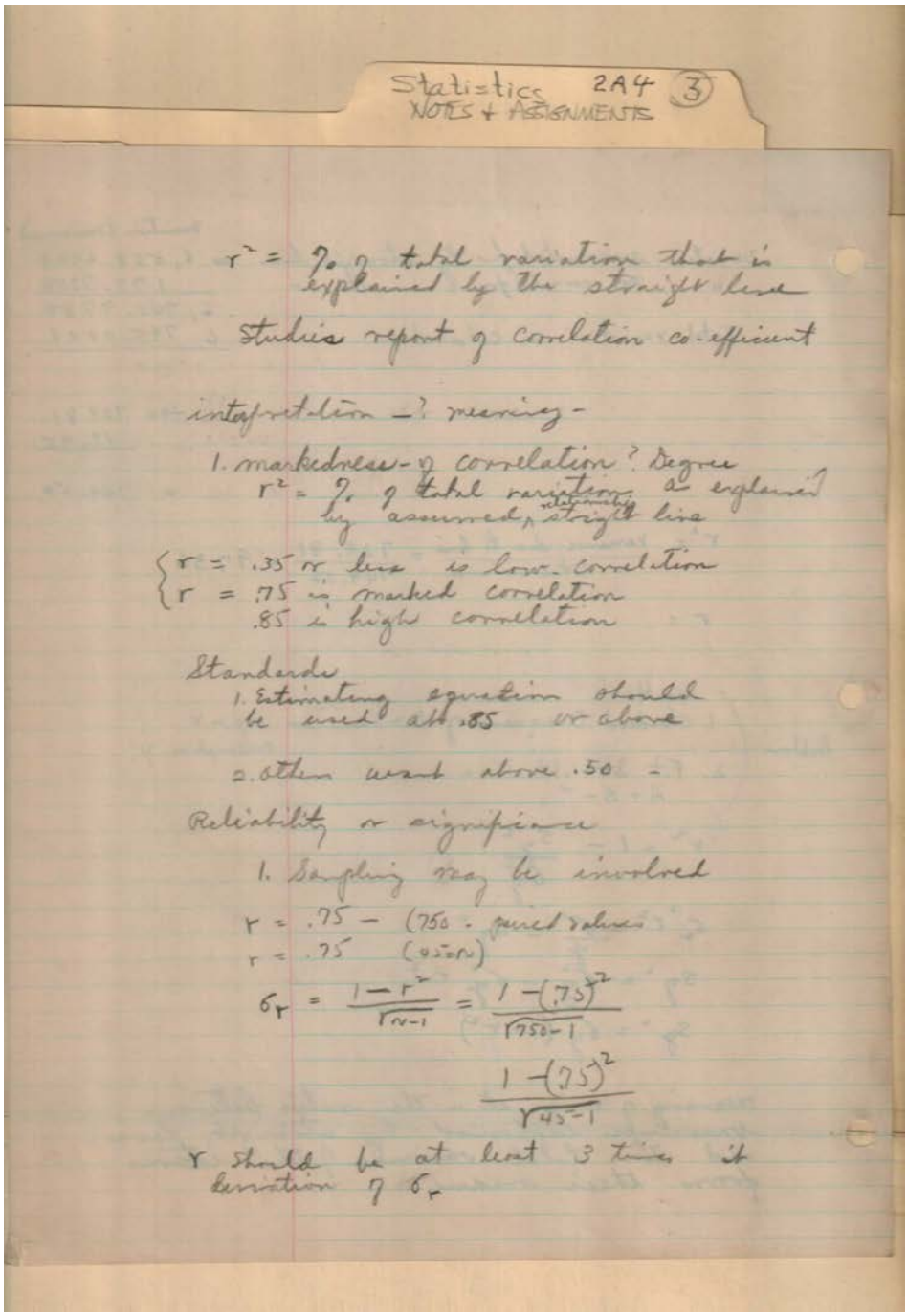

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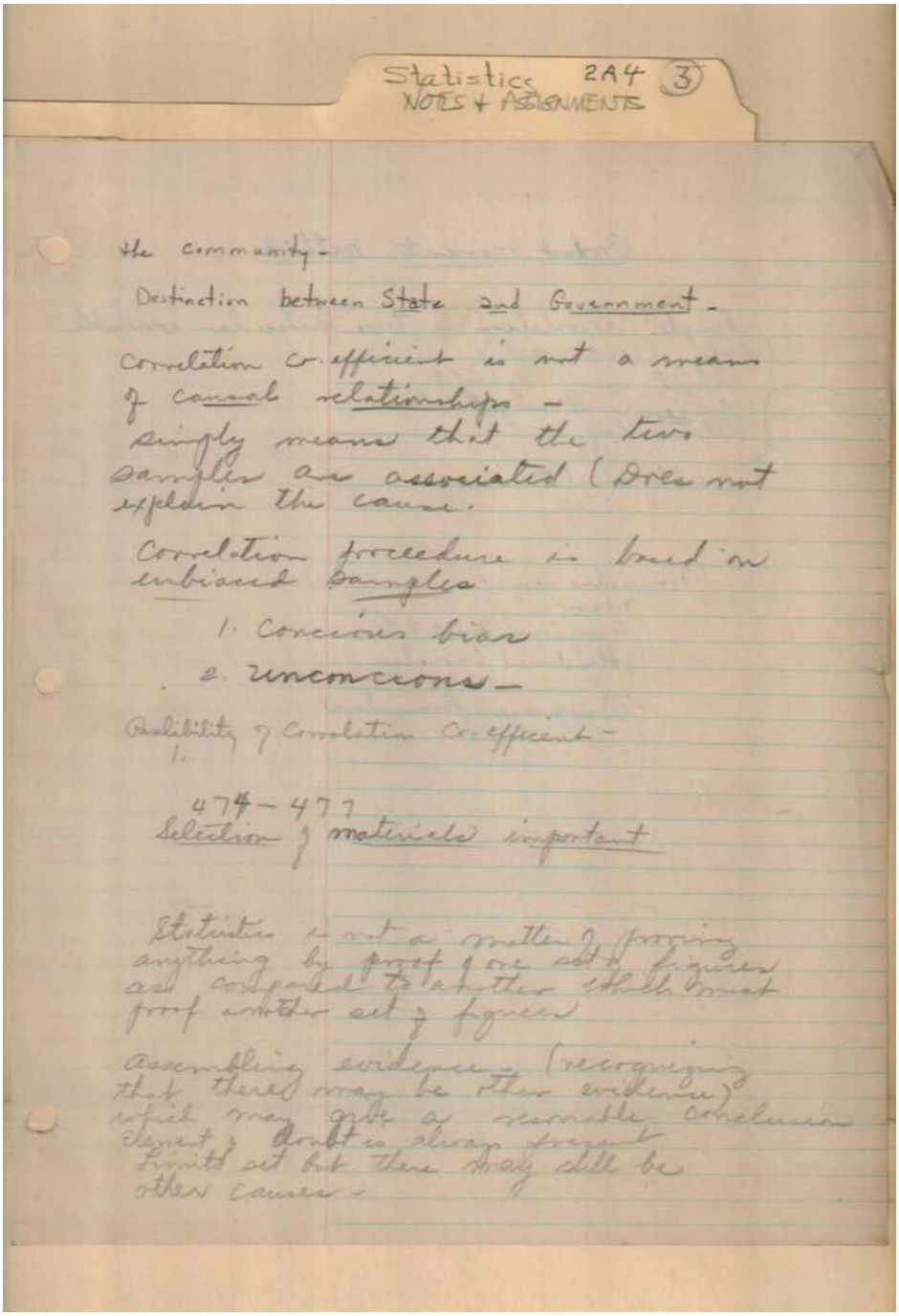


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

the community -

Destinction between State and Government -

Correlation Coefficient is not a means of causal relationships -
simply means that the two samples are associated (Does not explain the cause.

Correlation procedure is based on unbiased samples

1. Coercion bias
2. Unconcions -

Reliability of Correlation Coefficent -
1.

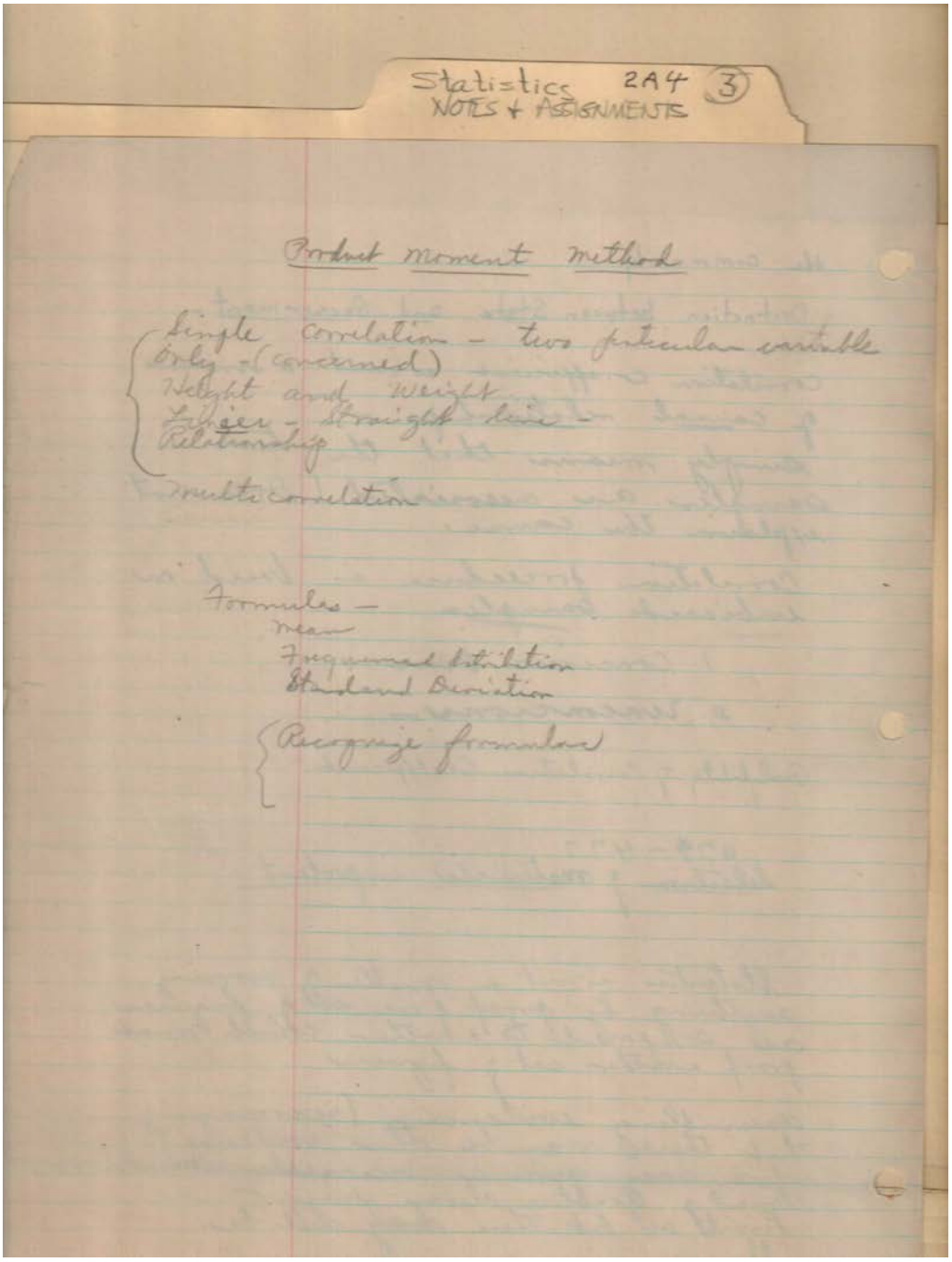
474 - 477
Selection of materials important

Statistics is not a matter of proving anything by proof of one set of figures as compared to another which must proof another set of figures

assembling evidence (recognizing that there may be other evidence) which may give a reasonable conclusion (agent) doubt is always present
Limits set but there may still be other causes -

Names:
Statistical Notes

Types:
notes



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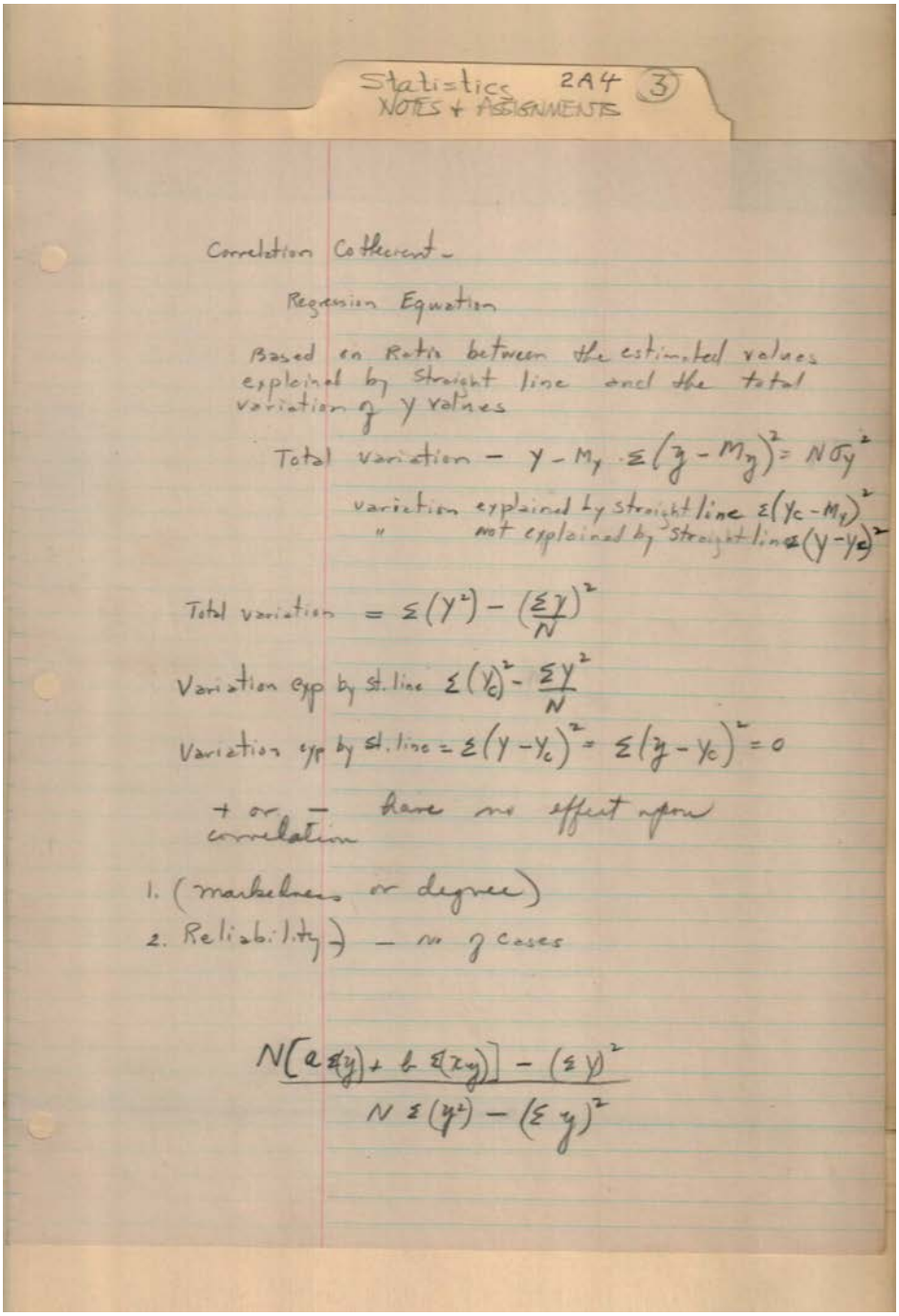


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Correlation Coefficient -

Regression Equation

Based on Ratio between the estimated values explained by Straight line and the total variation of y values

Total variation - $y - M_y \cdot \Sigma(y - M_y)^2 = N\sigma_y^2$

variation explained by straight line $\Sigma(y_c - M_y)^2$

" not explained by straight line $\Sigma(y - y_c)^2$

Total variation $= \Sigma(Y^2) - \frac{(\Sigma y)^2}{N}$

Variation exp by st. line $\Sigma(Y_c)^2 - \frac{\Sigma y^2}{N}$

Variation exp by st. line $= \Sigma(y - Y_c)^2 = \Sigma(y - Y_c)^2 = 0$

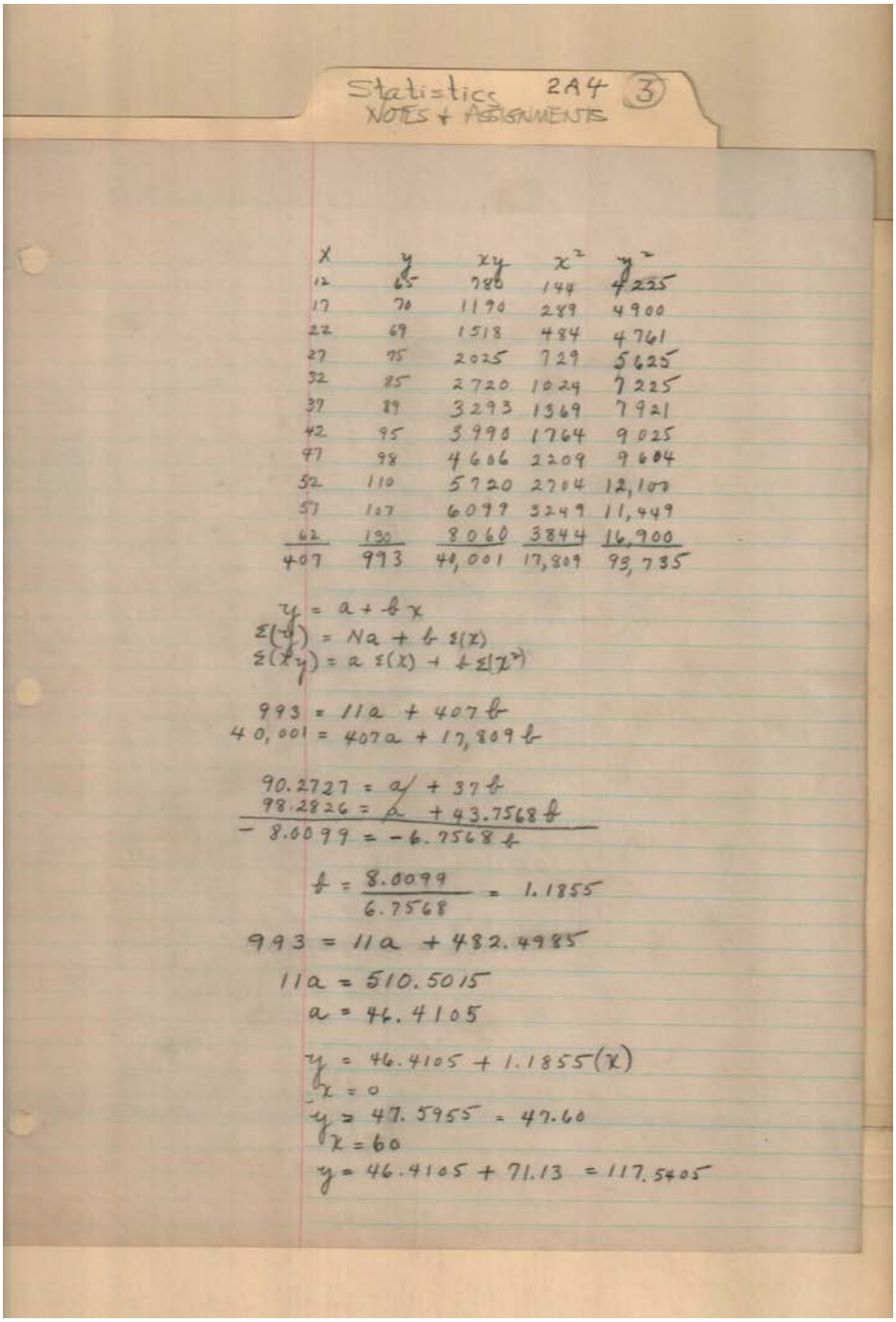
+ or − have no effect upon correlation

1. (marketness or degree)
2. Reliability) — in 9 cases

$$\frac{N[a\Sigma(y) + b\Sigma(xy)] - (\Sigma y)^2}{N\Sigma(y^2) - (\Sigma y)^2}$$

Names:
Statistical Notes

Types:
notes



x	y	xy	x^2	y^2
12	65	780	144	4225
17	70	1190	289	4900
22	69	1518	484	4761
27	75	2025	729	5625
32	85	2720	1024	7225
37	89	3293	1369	7921
42	95	3990	1764	9025
47	98	4606	2209	9604
52	110	5720	2704	12,107
57	107	6099	3249	11,449
62	130	8060	3844	16,900
407	993	40,001	17,809	98,735

$y = a + bx$

$\Sigma(y) = Na + b\,\Sigma(x)$

$\Sigma(xy) = a\,\Sigma(x) + b\,\Sigma(x^2)$

$993 = 11a + 407b$

$40,001 = 407a + 17,809b$

$90.2727 = a + 37b$

$98.2826 = a + 43.7568b$

$-8.0099 = -6.7568b$

$b = \frac{8.0099}{6.7568} = 1.1855$

$993 = 11a + 482.4985$

$11a = 510.5015$

$a = 46.4105$

$y = 46.4105 + 1.1855(x)$

$x = 0$

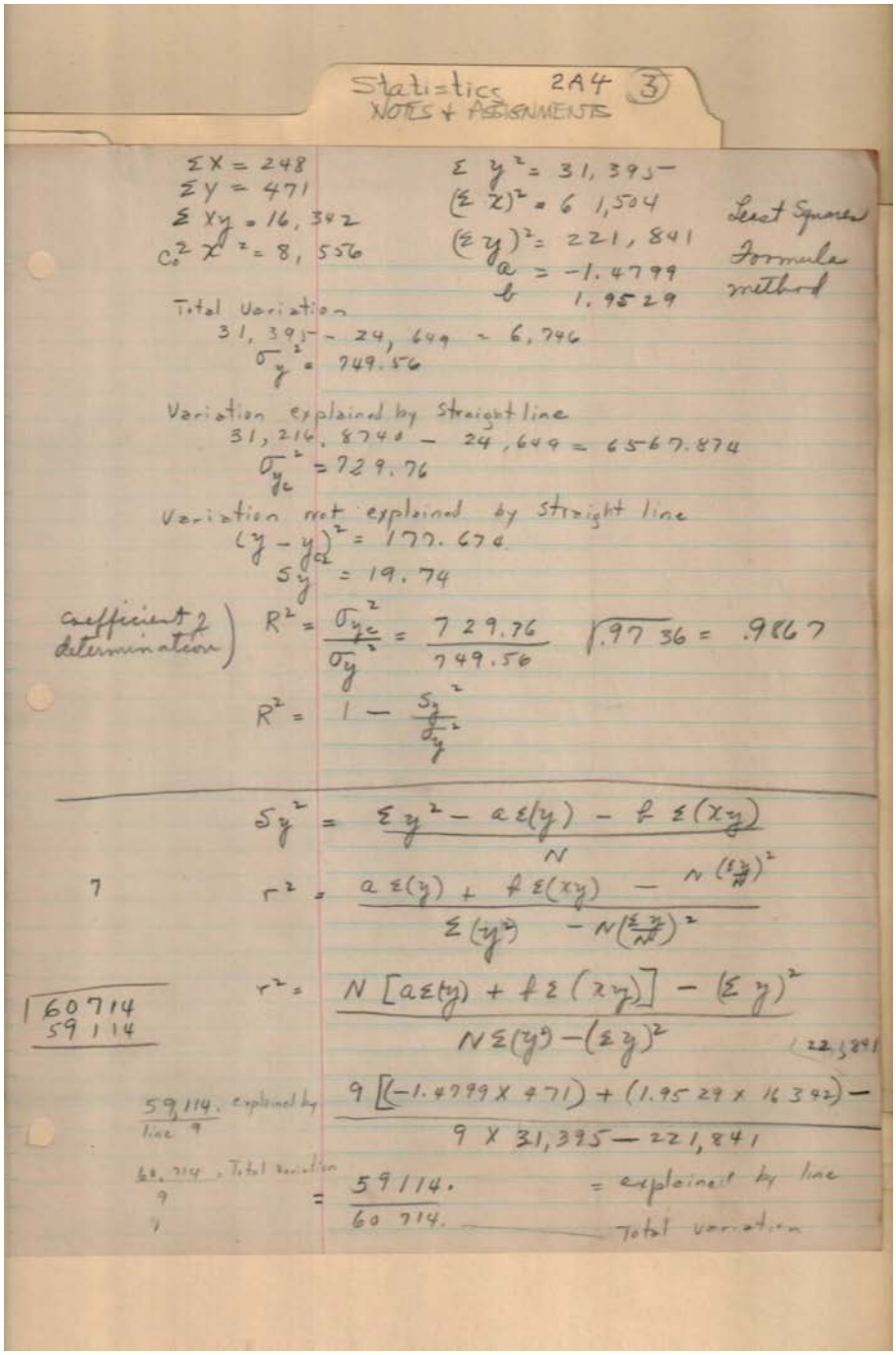
$y = 47.5955 = 47.60$

$x = 60$

$y = 46.4105 + 71.13 = 117.5405$

Names:
Statistical Notes

Types:
notes



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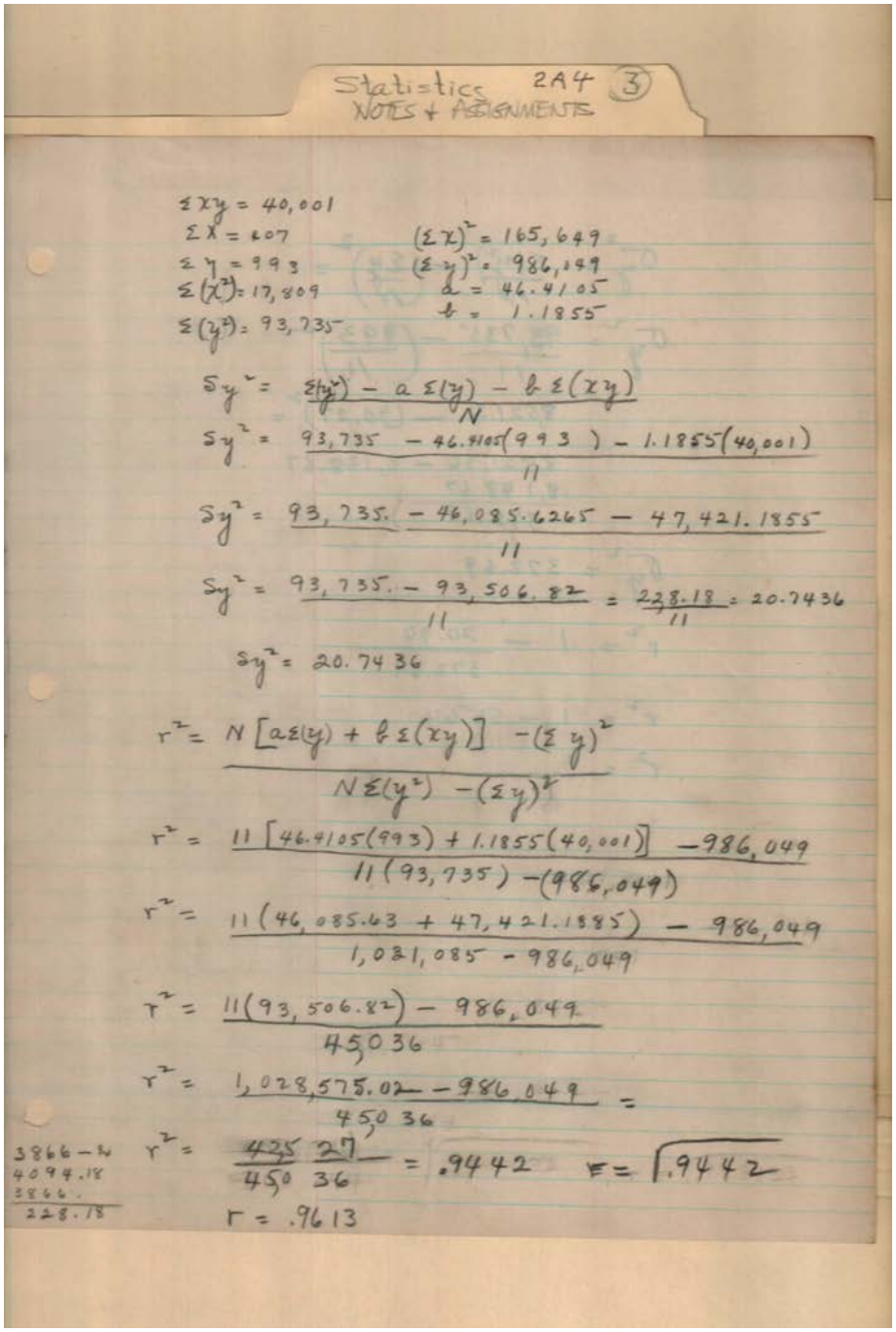


Statistics 2A4 (3)
NOTES + ASSIGNMENTS

$\Sigma xy = 40,001$
$\Sigma x = 407$ $(\Sigma x)^2 = 165,649$
$\Sigma y = 993$ $(\Sigma y)^2 = 986,049$
$\Sigma(x^2) = 17,809$ $a = 46.4105$
$\Sigma(y^2) = 93,735$ $b = 1.1855$

$$s_y^2 = \frac{\Sigma(y^2) - a\Sigma(y) - b\Sigma(xy)}{N}$$

$$s_y^2 = \frac{93,735 - 46.4105(993) - 1.1855(40,001)}{11}$$

$$s_y^2 = \frac{93,735. - 46,085.6265 - 47,421.1855}{11}$$

$$s_y^2 = \frac{93,735. - 93,506.82}{11} = \frac{228.18}{11} = 20.7436$$

$s_y^2 = 20.7436$

$$r^2 = \frac{N[a\Sigma(y) + b\Sigma(xy)] - (\Sigma y)^2}{N\Sigma(y^2) - (\Sigma y)^2}$$

$$r^2 = \frac{11[46.4105(993) + 1.1855(40,001)] - 986,049}{11(93,735) - (986,049)}$$

$$r^2 = \frac{11(46,085.63 + 47,421.1885) - 986,049}{1,031,085 - 986,049}$$

$$r^2 = \frac{11(93,506.82) - 986,049}{45036}$$

$$r^2 = \frac{1,028,575.02 - 986,049}{45036} =$$

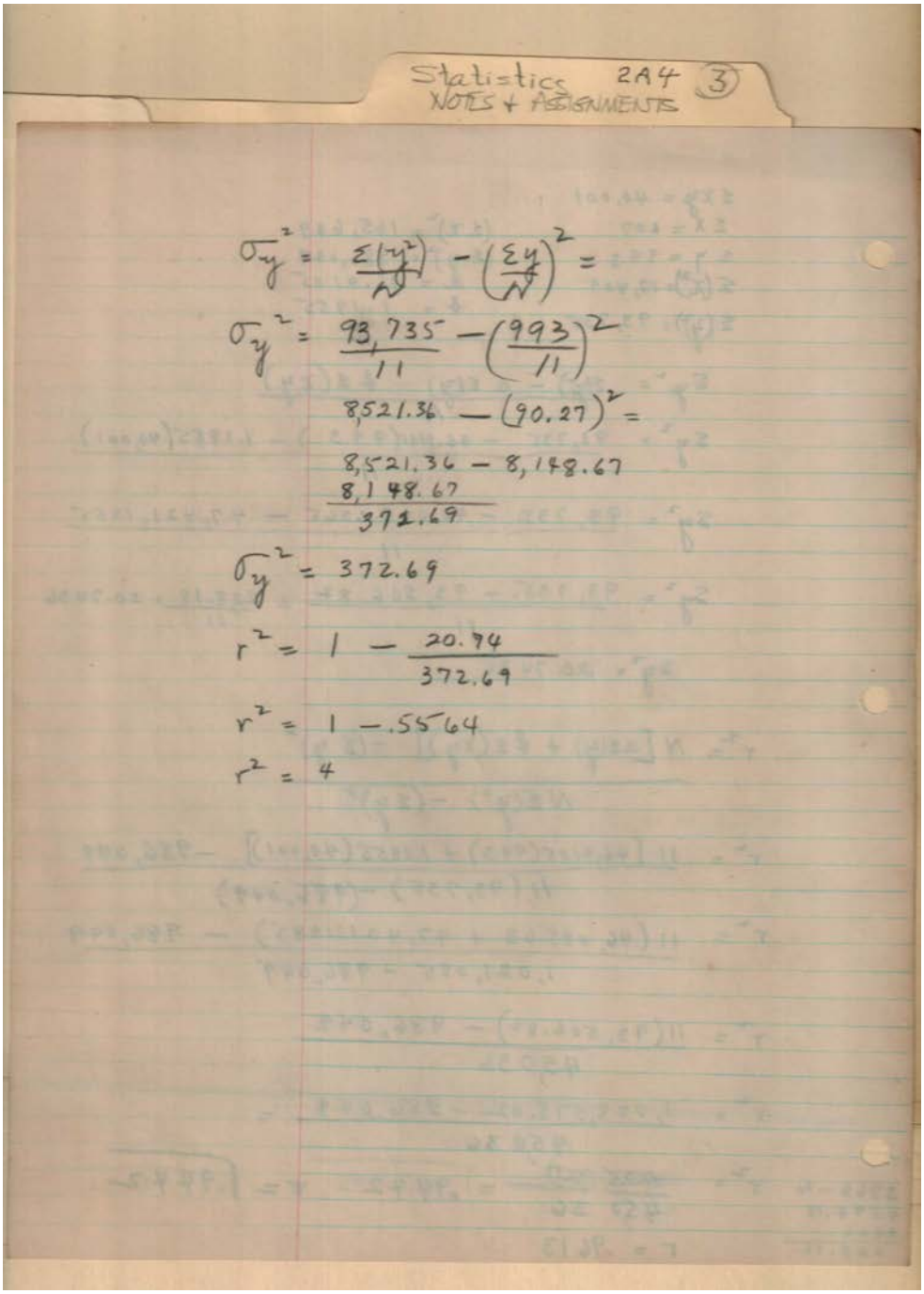
$$r^2 = \frac{425}{450}\frac{27}{36} = .9442 \qquad r = \sqrt{.9442}$$

$r = .9613$

3866 − N
4094.18
3866.
228.18

Names:
Statistical Notes

Types:
notes



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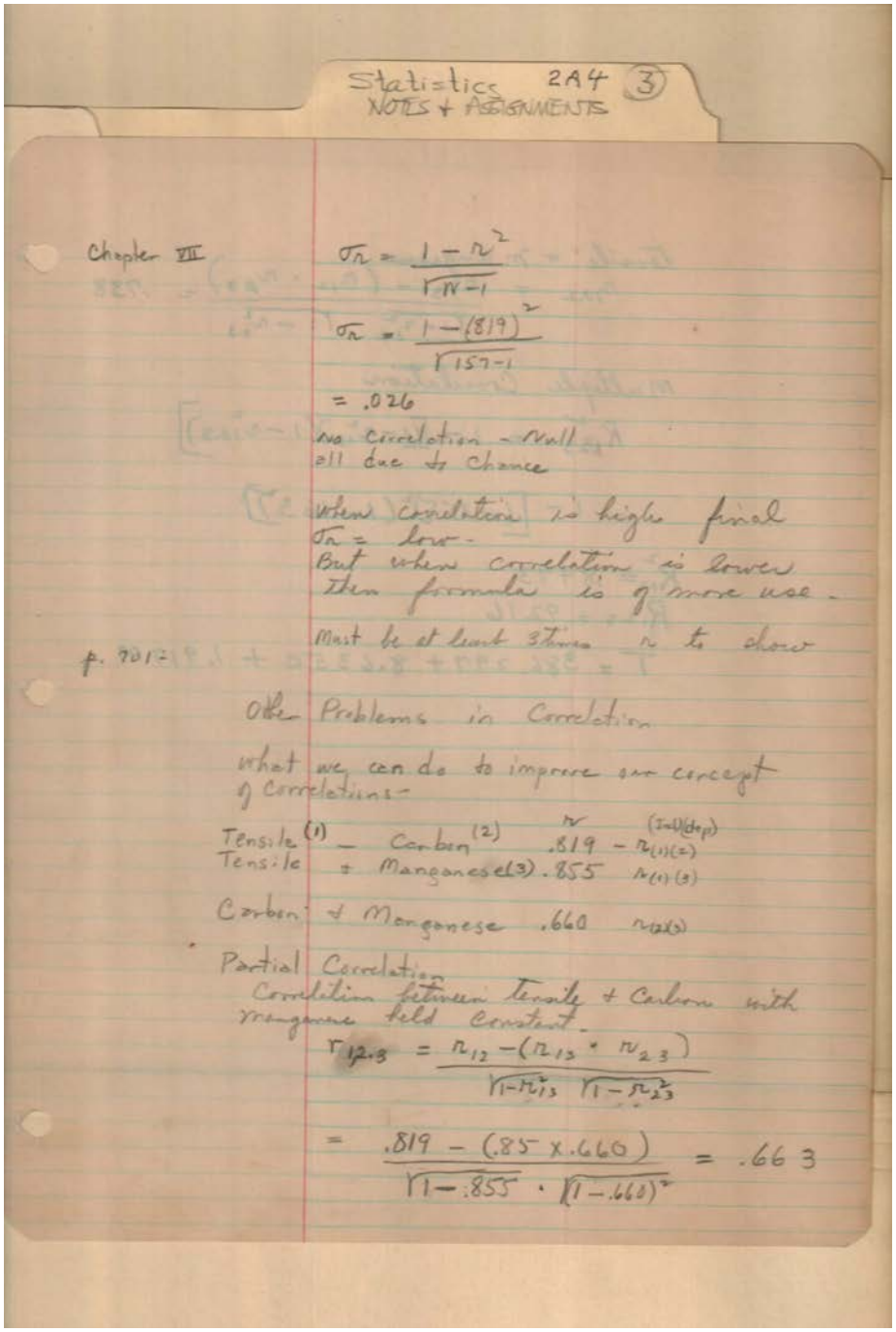
Statistical Notes

Types:
notes



Statistics 2A4 (3)
NOTES + ASSIGNMENTS

Chapter VII

$\sigma_r = \frac{1 - r^2}{\sqrt{N-1}}$

$\sigma_r = \frac{1-(.819)^2}{\sqrt{157-1}}$

$= .026$

no correlation - null
all due to chance

When correlation is high final σ_r = low.
But when correlation is lower then formula is of more use.

Must be at least 3 times r to show

p. 701

Other Problems in Correlation

what we can do to improve our concept of Correlations -

Tensile (1) — Carbon (2) r .819 $r_{(1)(2)}$
Tensile (1) + Manganese (3) .855 $r_{(1)(3)}$

Carbon (2) + Manganese .660 $r_{(2)(3)}$

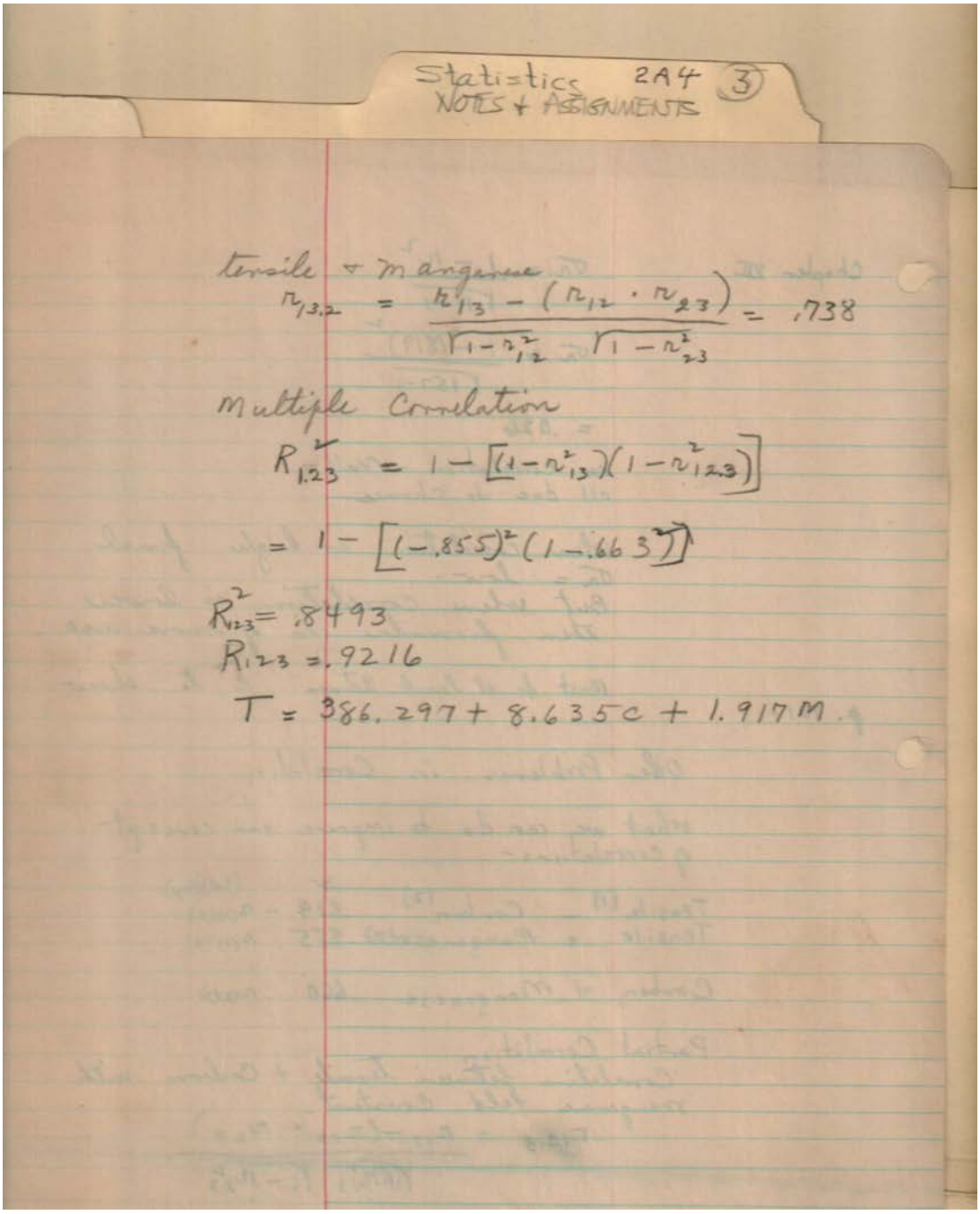
Partial Correlation
Correlation between Tensile + Carbon with manganese held constant.

$r_{12.3} = \frac{r_{12} - (r_{13} \cdot r_{23})}{\sqrt{1-r_{13}^2}\sqrt{1-r_{23}^2}}$

$= \frac{.819 - (.85 \times .660)}{\sqrt{1-.855} \cdot \sqrt{(1-.660)^2}} = .663$

Names:
Statistical Notes

Types:
notes



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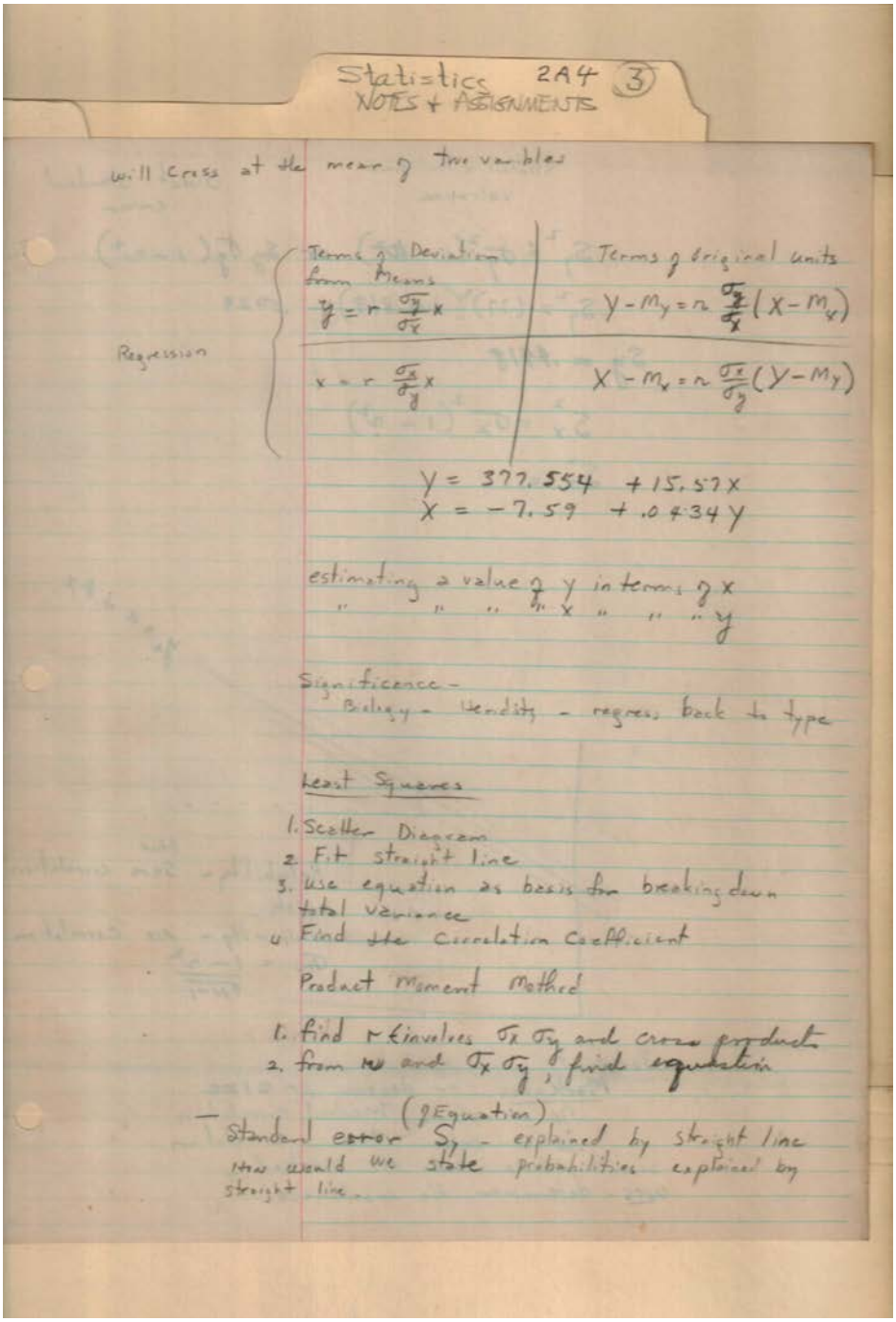

Statistics 2A4 (3)
NOTES + ASSIGNMENTS

will cross at the mean of two variables

Regression

Terms of Deviation from Means	Terms of Original Units
$y = r\frac{\sigma_y}{\sigma_x}x$	$y - m_y = r\frac{\sigma_y}{\sigma_x}(x - m_x)$
$x = r\frac{\sigma_x}{\sigma_y}x$	$x - m_x = r\frac{\sigma_x}{\sigma_y}(y - m_y)$

$y = 377.554 + 15.57x$
$x = -7.59 + .0434y$

estimating a value of y in terms of x
" " " " x " " " y

Significance -
Biology - Heredity - regress back to type

Least Squares

1. Scatter Diagram
2. Fit straight line
3. use equation as basis for breaking down total variance
4. Find the Correlation Coefficient

Product Moment Method

1. find r involves σ_x σ_y and cross product
2. from r and σ_x σ_y, find equation

(2 Equation)

Standard error S_y - explained by straight line
How would we state probabilities explained by straight line

Names:
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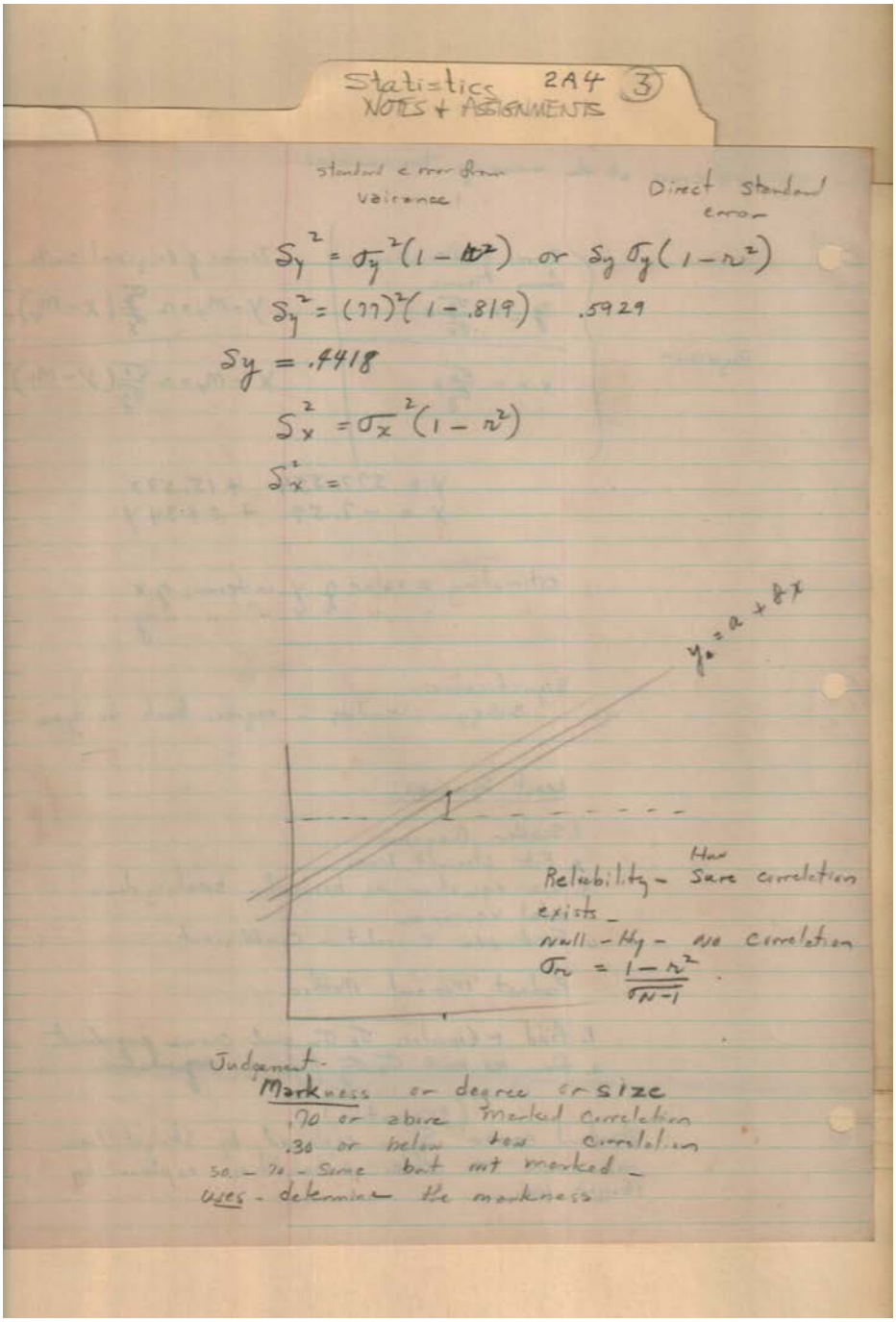

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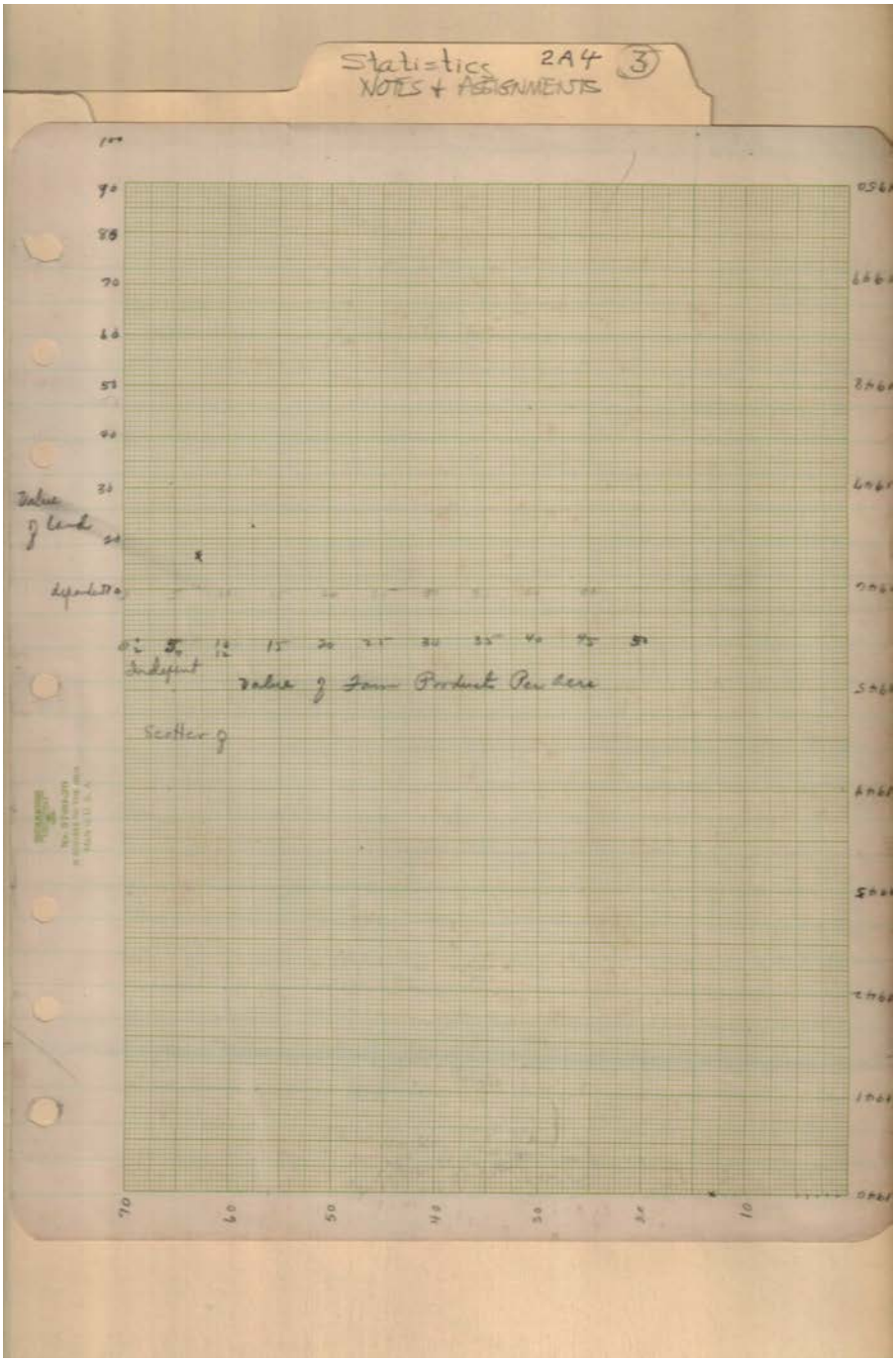

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