INDIAN STATISTICAL INSTITUTE

STATISTICIAN'S DIPLOMA EXAMINATION, PART 1—JULY 1949.

FIRST PAPER

Time allowed 4 hours. Full marks 100.

(It is not necessary to answer all the questions in order to secure full marks. Attempt as many as you like remembering that the questions do not carry equal marks and credit will be given according to the quality of the answers.)

1. (a) A box contains 4 rupee coins, 7 eight-anna pieces and 12 one-anna pieces. Five coins are taken out at random from the box. Calculate the probability that the total value of these five coins is at least Rs. 3/-. Find also the mean value of the five coins taken out at random.

(b) An urn contains a white and b black balls. Balls are removed one by one without replacement, until balls of one colour only are left. Find the expected number of balls left over.

2. The discrete stochastic variables $x_1, \ldots x_n$ are all distributed independently in Poisson's distributions with means $m_1, \ldots, m_n$ respectively.

Find (a) the distribution of the sum $x_1 + \ldots + x_n$ and (b) find the joint distribution of the variables $x_1, \ldots, x_n$ when their sum $x_1 + \ldots + x_n$ is kept fixed at $m_1 + \ldots + m_n$.

3. A computer was asked to analyse the marks obtained in the annual examination by the students of certain class in a school. He submitted the following final results to the Statistician.

(i) Total number of students 133
Number of students who failed in English .. 76
Number of students who failed in Mathematics .. 68
Number of students who failed in both English and Mathematics 7

(ii) The moments of the distribution of the marks in English:

$\mu_2 = 67, \quad \mu_3 = 927, \quad \mu_4 = 12570$

(iii) The Correlation between the marks:
English and Mathematics .. .. .. .93
English and Science .. .. .. .98
Mathematics and Science 99

The Statistician, however, rejected the calculations as wrong and asked him to calculate again. Can you state the reasons why the Statistician rejected the calculations as wrong?

4. (a) Give in detail the various uses of the χ^2-statistic.

(b) Examine critically the following remark of Fisher

"The χ^2 test does not attempt to measure the degree of association, but as a test of significance it is independent of all additional hypothesis as to the nature of the association."

5. State (without proof) the law of addition of several variables, each following distribution with $m_1, \ldots, m_n$ degrees of freedom.

If $p_1, \ldots, p_n$ have rectangular distribution over (0, 1) and $P = p_1 p_2 \ldots p_n$, show that the distribution of P is given by

$$f(P)dP = \frac{1}{\Gamma(n)} (\log P)^{n-1} dP$$

Show also how this distribution may be used for combining the results of a number of tests of a hypothesis from independent samples.

6. Describe a method of determining large sample standard errors of functions of sample moments. Use this method to calculate the standard error of the sample coefficient of variation, when the population mean and standard deviation are μ and σ respectively, and sample size is n.

7. Fisher writes in his Statistical Methods for Research Workers as follows:

"The idea of regression used usually to be introduced in connection with the theory of correlation, but it is really a more general, and a simpler idea; moreover, the regression coefficients are of interest and scientific importance in many classes of data where the correlation coefficient, if used at all, is an artificial concept of no real utility."

Comment critically on the observation bringing out the similarity and difference between the regression concept and the correlation concept.

8. Write a note on the concept of 'regression' in Statistics.

The following structural relationship is suggested between (1) unit cost per article (c), (2) price index of raw materials (I) and (3) work load (W) in an industrial establishment.

$$c = a + bI + \frac{c}{W}$$

where the variable c is subject to change and the other two variables can be accurately measured.

How can we estimate the structural parameters a, b and c ?

9. Derive the formula for the variance of an estimated value as determined by the theory of regression. If the estimating formula is $Y = a + b(x - \bar{x})$ then justify the following statement of Fisher:

"For values of x near the mean, that is, where $(x - \bar{x})$ is small, this variance (of Y) will not greatly exceed that at the mean of the observed sample, but for values more remote from the centre of our experience the precision of the estimate is naturally lower, and the second component of the error, due to the estimation of b, becomes predominant."

10. Comment on the following remark of Fisher:

"In a well planned experiment certain restrictions may be imposed upon the random arrangement of the plots in such a way that the experimental error may still be accurately estimated, while the greater part of the soil heterogeneity may be eliminated."
How proper designing of an experiment helps to reduce experimental error ?

11. Write short notes on the concepts of (a) consistency (b) efficiency and (c) sufficiency of a statistic. Give an example of a probability distribution admitting a sufficient statistic for a parameter.

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STATISTICIAN'S DIPLOMA EXAMINATION, PART I—JULY 1949

SECOND PAPER

Time allowed 4 hours Full marks 100.

(It is not necessary to answer all the questions in order to secure full marks. Attempt as many as you like remembering that the questions do not carry equal marks and credit will be given according to the quality of the answers.)

1. What are the chief components of an economic time series and how would you decompose such a series? Give a general exposition of the method commenting on the adequacy or otherwise of the statistical procedure employed in this connexion.

2. In analysing the real position of industrial workers, would you compare an index of retail prices with an index of wage rates of full time earnings, of average weekly earnings or some other concept? Describe the limitations of such a procedure.

3. What are the chief sources of official statistics relating to India's external trade? What difficulties are encountered in the interpretation of such data?

Explain the general method of construction of Index Numbers of the physical volume and average value of external trade from such data.

4. State briefly what is meant by 'statistical demand curve'. How would you derive such a curve in the case of a staple agricultural crop?

5. What do you understand by 'Index of Business Activity'? Explain fully how you would set about constructing such an index for India. Would you combine agricultural and industrial production in this connexion? Give reasons for your answer.

6. Explain what is meant by 'Gross Reproduction rate' and 'Net Reproductioin rate' sketching in a tabular form the type of data needed for the purpose and indicating the method of calculation of these measures. Why and in what sense are these measures, especially the latter, supposed to furnish indication of how a particular population will tend to replace itself.

7. Describe briefly how to collect data and infer about the nature of inheritance of a rare malady like Albinism in human populations.

8. Write notes on any three of the following terms used in Genetics.

(a) Mendelism (b) Dominance

(c) Linkage (d) Polysomic inheritance.

9. What is Spearman's two factor theory? Describe a method of factorising the correlation matrix with a view to discover the general and specific factors affecting the performance of a group of persons in a battery of tests.

10. Prepare in broad outline the design for sampling survey in your Province to assess the achievements of the Grow-More-Food Campaign and draw up an appropriate schedule form for collecting the necessary information.

11. An experimenter wanted to study the influence of three factors, viz., pressing time, temperature and pressure on the adhesive strength of a glue used in the manufacture of plywood. The results of his experiments are given below.

Factor studied & its magnitude	Number of replications	Mean strength of glue adhesion in lbs./sq. in.
(i) *Time of Pressing*	*Pressed at* 300°*F and* 200 *lbs./sq.in*	
18 minutes	3	318
12 "	3	283
6 "	3	331
(ii) *Temperature°F*	*Pressed for* 12 *minutes at* 200 *lbs/sq.in.*	
210	4	282
240	4	309
270	4	369
300	2	419
(iii) *Pressure lbs/sq.in*	*Pressed for* 12 *minutes at* 300°*F*	
100	4	328
150	4	355
200	4	345
300	4	490
500	4	422
750	4	469
1000	3	469

Point out the defects in the design of this experiment. Suggest an appropriate design explaining the new principles which you will introduce in that design.

STATISTICIAN'S DIPLOMA EXAMINATION, PART I—JULY 1949.

THIRD PAPER (Practical)

Time allowed 6 hours. Full marks 100.

1. The distribution of the balances at credit of the individual savings accounts of a non-scheduled Bank in Calcutta, as observed on 30 June 1947, was as follows:

class intervals of credit balance in rupees	number of individuals
Below 5/-	2779
6— 25/-	4725
26— 50/-	1444
51— 100/-	1325
101— 500/-	2859
501— 1000/-	826
1001— 5000/-	842
5001— 10000/-	86
10001— 50000/-	22
50001— 100000/-	2
Total	14910

At what level of the balance, reckoned from the lowest upwards (i) 75% of individuals accounts lie and (ii) 25% of the total funds in the savings department is built up; also at what level of balance reckoned from the highest downwards do (iii) 25% of individuals lie and (iv) 75% of the total savings funds are made up. Calculate the above both (a) graphically and (b) by interpolation using differences of the third order.

2. The following gives the gross monthly sales of all the products of a pharmaceutical concern in West Bengal from January 1945 to May 1949.

(a) Fit a linear trend to the monthly figures and determine the seasonal indices.

(b) Also, predict the likely volume of sales in the remaining months of 1948.

Months	Gross sales in (000) rupees			
	1945	1946	1947	1948
January	47.4	87.0	197.7	190.7
February	56.5	85.8	222.2	240.6
March	58.8	116.5	198.1	205.9
April	90.1	117.6	157.5	235.6
May	86.3	169.5	250.7	
June	102.5	152.8	218.7	
July	102.3	179.2	219.8	
August	125.4	163.0	194.1	
September	98.2	200.5	269.9	
October	115.3	200.1	250.2	
November	125.8	201.0	242.0	
December	158.0	307.0	309.6	
Total	1166.6	1980.0	2710.5	

3. Samples of size $n=25$ are taken out of a population in which two variates have the correlation coefficient $P=0.6$. The moments about the origin of the distribution of the observed correlation coefficient r are given by the formulae:

$$\mu'_1 = \rho\,\frac{q_n}{q_{n-1}}\left(1+\frac{1\cdot2}{n+1}\,\frac{\rho^2}{2}+\frac{1^2.3^2}{1.2.(n+1)(n+3)}\,\frac{\rho^4}{4}+-\frac{1^2.3^2.5^2}{3!(n+1)(n+3)(n+5)}\,\frac{\rho^6}{8}+..\right)$$

$$\mu'_2 = 1-\frac{q_n}{q_{n-2}}\,(1-\rho^2)\left[1+\frac{2^2}{n+1}\,\frac{\rho^2}{2}+\frac{2^2.4^2}{2!(n+1)(n+3)}\,\frac{\rho^4}{4}+\frac{2^2.4^2.6^2}{3!(n+1)(n+3)(n+5)}\,\frac{\rho^6}{8}+.\right]$$

$$\mu'_3 = \mu'_1-\rho(1-\rho^2)\,\frac{q_{n-2}}{q_{n-1}}\,\frac{n-2}{2}\left[1+\frac{3^2}{n+3}\,\frac{\rho^2}{2}+\frac{3^2.5^2}{2!(n+3)(n+5)}\,\frac{\rho^4}{4}+..\right]$$

$$\mu'_4 = 2\mu'_2-1+\frac{n(n-2)}{n^2-1}\,(1-\rho^2)^2\left[1+\frac{4^2}{n+3}\,\frac{\rho^2}{3}+\frac{4^2.6^2}{2!(n+3)(n+5)}\,\frac{\rho^4}{4}+..\right]$$

Value of the integral $q_n = \int_0^{\frac{\pi}{2}} \mathrm{Sin}^{n-1}\phi\, d\phi$

n	q_n	n	q_n
20	.283773	25	.253181
21	.276770	26	.248169
22	.270260	27	.243444
23	.264180	28	.238978
24	.258510	29	.234749

From the above relations giving the said moments of the r distribution in terms of the observables, determine the best fit of the r distribution within the Pearsonian system.

4. A metropolitan establishment of Outfitters sells ready made garments. For certain type of garment A, which is sold in 15 standard sizes 26-40, it was found that the mean size of the 23754 garments sold during the 10 years 1930-39 is 32.92 with a standard deviation 2.16, the distribution being sensibly normal.

(a) The establishment wants to manufacture garments for the next 2500 customers. How many pieces of each size should they manufacture in order that the supply approximates as closely as possible to the demand? For each of the sizes 31-35 find approximately the upper limit by which the actual number of customers (among the next 2500) may exceed or fall short of the number of pieces manufactured.

(b) The establishment opens a new suburban branch. The frequency distribution in respect of size of the first 500 pieces sold is observed to be as follows.

Size	f	Size	f
26	1	34	70
27	3	35	46
28	8	36	35
29	17	37	16
30	43	38	5
31	50	39	3
32	98	40	1
33	104		

Can the relative demand for the different sizes be regarded as the same for the suburban locality as for the metropolitan area?

STATISTICIAN'S DIPLOMA EXAMINATION, PART I—JULY 1940.

FOURTH PAPER (Practical)

Time allowed 6 hours. Full marks 100.

1. You are provided with the following figures on cotton growing and meteorological factors of the Bellary district—Madras Presidency during the years 1911-12 to 1930-31.

The Yield figures have been expressed as ratios of the actual yield in a year to the 5 year moving average ending in that year, and the weather factors have also been expressed as ratios in the same way:

Year	Yield ratios x_0	September rain fall x_1	November temperature x_2
1911–12	107	57	101
12–13	118	117	97
13–14	108	61	102
14–15	89	84	101
15–16	102	153	97
16–17	157	92	94
17–18	122	173	97
18–19	121	87	99
19–20	108	143	99
20–21	54	68	104
21–22	90	21	98
22–23	77	17	98
23–24	75	103	105
24–25	112	135	98
25–26	122	98	97
26–27	125	157	101
27–28	119	167	96
28–29	120	68	100
29–30	101	137	98
30–31	87	78	99

Calculate the multiple correlation coefficient $R_{0\cdot 12}$ and test its significance.

2. The following results are obtained from anthropometric studies on certain tribes and castes of U.P. (Census of 1941).

Tribe or caste	Number of subjects measured	Correlation coefficient between characters, 'Head breadth' and 'Bizygomatic breadth'.
1. Chero	100	0.4904
2. Kharwar	197	0.4835
3. Oraon	100	0.4902
4. Rajwar	105	0.4718
5. Korowa	101	0.6001
6. Brahmin (Basti)	86	0.7458
7. Chhatri	139	0.0640
8. Ahir	68	0.3370
9. Kurmi	94	0.3652

Can you consider the correlation coefficients for the different castes and tribes to be significantly different?

INDIAN STATISTICAL INSTITUTE

COMPUTER'S CERTIFICATE EXAMINATION, August 1949.

Part 1A: Section 1

Time allowed 3 hours (No machine allowed) Full marks 100.

1. Evaluate

(a) $\frac{0.001}{1000} + \frac{5.0}{0.05} \div 9 - 15.36954$

(b) $\frac{(4115)^3}{(12345)^3} + \frac{\sqrt[3]{54328}}{\sqrt[4]{6791}} \div 1.125 + 5.30968$

(c) $\frac{(0.25)\ (2330)}{0.125 \times 4678} \div \frac{0.5}{0.25} - \frac{\frac{13}{0.39}}{\frac{17}{0.85}}$

(d) $3.03 \div 25.253 \div \frac{45}{99} - 7\frac{73}{900}$

2. A computer was asked to compile certain figures regarding a district and he submitted the following figures. Scrutinize them, pick out suspicious figures and state your reason for considering them to be suspicious.

(1) Total area of the district 2530 sq. mi.
(2) Total no. of police stations in the district 10
(3) Density of population per sq. mile—252
(4) Total no. of families in the district — 9653
(5) Total cultivated area .. .. 1395.5 sq. mi.
(6) Area cultivated more than once .. .. 233.2 " "
(7) Total forest area .. .. 601.7 " "
(8) Total water area .. .. 638.3 " "
(9) Size of a Police Station .. .. 250.0 " "
(10) Size of family 5.9
(11) Average consumption of rice per month .. 7,52,322 maunds
(12) Percentage of Hindus 63.3, Percentage of Muslims 36.2, Percentage of others 1.9.

3. Complete the table given below:

X	Y	Z	X^2	Y^2	Z^2	XY	XZ	YZ	$(X\ Y\ Z)^2$
5	9	8							
13	17	27							
0	11	9							
15	6	18							
16	10	0							
19	12	23							
14	9	11							
18	13	17							
22	18	27							
25	11	16							
27	22	12							
Total									

4. Area of a triangle is given by $\sqrt{s(s-a)(s-b)(s-c)}$ where $s=(a+b+c)/2$=half of the sum of the sides, a, b & c being the sides of the triangle.

Calculate the area of a triangle whose sides are 3.73, 4.9 and 1.925 units respectively.

5. An electric train moves at a speed of 100 miles per hour for 1st hour. Its speed during the second hour exceeds that for the first by 5% and that of third hour exceeds the speed of 2nd hour again by 5%. The speed goes on increasing in the above way and the train moves for a total of 7 hours.

Another train moves at the rate of 100 miles per hour for the first hour. Its speed goes on increasing at the rate of 5 miles per hour at the end of each hour. This train also moves for 7 hours.

(a) What is the total distance travelled by each?

(b) What is the maximum speed attained by each during the 7th hour?

COMPUTER'S CERTIFICATE EXAMINATION, AUGUST 1949.

PART 1A: SECTION 2

Time allowed 3 hours. Full marks 100.

(Machine not allowed)

1 The following table gives the population (in thousands) of two towns P and Q at the beginning of each of the years specified:

Year	1835	1845	1855	1865	1875	1880	1890
P	24.4	26	29.5	34	40	43	50
Q	34	36	38.4	41.1	43	44.8	46.7

Plot the graphs on the same diagram, and estimate the population of each town at the beginning of 1870. In what year was the population approximately the same in both the towns?

2. *Either*

(a) Solve: $x + 2 - \frac{6}{x-2} = 1$

(b) If $x + \frac{1}{x} = 2.3125$, find the value of $x^4 + \frac{1}{x^4}$

Or

The following table shows the respective weights and the percentage rises in the price level at the end of December, 1943 of the several groups constituting the Calcutta Wholesale Price Index Number above the respective base period price levels. Calculate the index number for December, 1943.

Groups	Weights	% rise in price levels
Cereals	8	162
Pulses	6	295
Sugar	3	234
Tea	3	20
Other food articles	9	278
Oilseeds	3	195
Mustard oil	2	137
Raw Jute	3	10
Jute Manufacture	4	98
Raw cotton	2	61
Other textiles	2	102
Hides skins	3	1
Metals	6	201
Other raw & Manufactured articles	8	140

3. The average weight of the 35 men in dormitory A is 140.4 pounds

" " 67 " " B " 139.3 "

" " 96 " " C " 138.6 "

Only dormitory C contains 22 Muslims whose average weight is 136.3 lbs. Find the average weight of the non-muslims in all dormitories.

4. The age distribution of a group of men who were married in a certain year was

Age last birthday in years	No. of men	Age last birthday in years	No. of men
14.5—19.5	15	39.5—44.5	19
19.5—24.5	836	44.5—49.5	10
24.5—29.5	411	49.5—54.5	5
29.5—34.5	149	54.5—59.5	3

(i) Calculate the mean and standard deviation (σ) of the distribution.

(ii) Find the percentage of men within $\pm\sigma$, $\pm 2\sigma$, and $\pm 3\sigma$ of the mean of the distribution.

COMPUTER'S CERTIFICATE EXAMINATION, AUGUST 1940.

PART 1B: SECTION 1.

Time allowed 3 hours. Full marks 100

(Machines and Tables allowed)

1. The life experience of 1,000 wooden telephone poles is given by the following frequency distribution:

Life in years	No. of poles replaced	Life in years	No. of poles replaced
0.5— 1.5	4	11.5—12.5	95
1.5— 2.5	7	12.5— 13.5	91
2.5— 3.5	15	13.5— 14.5	73
3.5— 4.5	32	14.5—15.5	64
4.5— 5.5	30	15.5— 16.5	38
5.5— 6.5	57	16.5—17.5	30
6.5— 7.5	61	17.5—18.5	18
7.5— 8.5	73	18.5—19.5	5
8.5— 9.5	96	19.5—20.5	1
9.5—10.5	104	20.5—21.5	1
10.5—11.5	103	21.5—22.5	2
		Total	1000

(a) Calculate the mean, standard deviation and median of the distribution.

(b) Draw a free-hand smooth cumulative frequency curve of the distribution and verify the value of the median found in (a).

2. The following table gives the yields of first and second plots in pounds.

	yield of first plot							
	66–88	89–111	112–134	135–157	158–180	181–203	204–226	Total
20– 42				1				1
43– 65			1					1
66– 88	2	2	2					6
89–111		4	4	3	2	1		14
112–134		5	11	4	11	3		34
135–157	1	1	12	15	16	5	2	52
158–180		1	11	16	13	11	2	54
181–203	1		1	9	13	4	2	30
204–226					3	1		4
227–249						2		2
Total	4	13	42	48	58	27	6	198

Calculate the correlation coefficient between the yields of first and second plots. Also find the estimates of the yields of first plot when the yields of the second plot are 102, 150 and 165.

3. The earning capacity of persons of 12 different age groups is shown in the following table:

Age group	Earning capacity	Age group	Earning capacity
15–19	.56	45–49	.93
20–24	.71	50–54	.86
25–29	.84	55–59	.76
30–34	.92	60–64	.66
35–39	.97	65–69	.56
40–44	.98	70–74	.46

Numbering the age groups from 1 to 12 in the ascending order, fit a curve to the data of the form

$$y = a + bx + cx^2$$

where x is the number of the age group and y is the corresponding earning capacity.

COMPUTER'S CERTIFICATE EXAMINATION, August 1949.

PART IB: SECTION 2

Time allowed 3 hours. Full marks 100.

(Machines and Tables allowed)

1. Work out with the help of logarithmic tables the value of

$$\frac{(.039)^{.37}\,(50.72)^{1.03}\,(.0031417)^{.01}}{(.007654)^{.5}}$$

2. For a function of two variables x, y, the following four values have been observed for the combinations of $x = 0.45, 0.50$ and $y = 5, 7$.

x / y	0.45	0.50
5	.0691080	.1093750
7	.0181230	.0351562

Find the value of the function corresponding to $x = 0.47$ and $y = 6.5$, by simple linear interpolation.

3. The following table gives the distribution of a number of school children classified according to their standard of clothing and according to their intelligence.

Intelligence / Clothing	very dull	dull	slow but intelligent	fairly intelligent	very intelligent
very well clad	33	48	113	209	233
well clad	41	100	202	255	153
poor but passable	39	58	70	61	37
very badly clad	17	13	22	10	11

Find out whether there is any significant association between intelligence and the standard of clothing.

4. For settling some of the refugees in West Bengal, it is proposed to make a survey of the distribution of waste land in West Bengal. What types of statistical information will be required for this purpose and how far are they available from existing government publications?

5. The following tables gives the distributions of mean temperatures for the months of June and July in Stockholm during the 100 years 1841-1940. Fit a normal curve to the given data and work out the expected frequencies for the given class intervals. Also test whether the normal curve is suitable for graduation of the observed frequencies.

Temperature in degree (celsius)	Frequency
12.0-12.4	10
12.5-12.9	12
13.0-13.4	9
13.5-13.9	10
14.0-14.4	19
14.5-14.9	10
15.0-15.4	9
15.5-15.9	6
16.0-16.4	7
16.5-16.9	8
Total	100

The mean and S.D. of this observed frequency distribution are 14.23 and 1.574 respectively.

COMPUTER'S CERTIFICATE EXAMINATION, August 1949.

Part IC: Section I.

Time allowed 3 hours. Full marks 100.

(Machines and tables allowed)

1. Fit a second degree parabola to the following data and estimate the value of the Index for 1940.

Year	Index of whole-sale prices at Calcutta.
1931	96
1933	87
1935	91
1937	102
1939	108
1941	139
1943	307
1945	280

2. The following table gives wheat yield, temperature and rainfall over a certain area for 30 years. Fit a regression, plane with wheat yield as the dependent variable temperature and rainfall as independent variables. Test the significance of the partial correlations involved i.e. $r_{13\cdot2}$ and $r_{12\cdot3}$.

wheat yield x_1	winter temp. x_2	rainfall x_3	wheat yield x_1	winter temp. x_2	rainfall x_3
1690	2.7	230	2150	2.5	351
1950	3.1	208	2530	0.8	324
1630	1.9	188	2100	0.8	190
1720	1.3	315	2330	3.6	381
1560	1.0	180	1850	1.6	273
1680	1.6	261	2230	1.9	289
1980	2.3	216	2510	2.2	338
2180	1.7	346	2000	3.0	267
2370	3.1	131	2480	3.2	372
1790	1.1	256	1940	2.8	357
2100	1.6	327	2770	2.1	358
1110	0.1	320	2570	3.3	202
2570	3.7	382	2510	3.8	311
2180	1.1	279	1420	−1.1	172
810	−0.4	194	1900	−2.4	261

3. Evaluate

$$y = e^{-2x}\left(1 + \frac{x}{5}\right)^{15}$$

for $x = -3, -2, -1, 0, +1, +2, +3, +4, +5$.

COMPUTER'S CERTIFICATE EXAMINATION, August 1949.

Part 1C: Section 2.

Time allowed 4 hours. Full marks 100.

(Machines and Tables allowed).

1. The tables for 95% points for L (a transformed variate of D^2 Statistic) for $p=2$ and 3 are given below.

95% values of L

p \ λ	4.00	5.00	6.00	8.00	12.00
2	2.52	3.47	4.45	6.42	10.40
3	2.67	3.59	4.55	6.49	10.44

For $p=2$ and 3 and $L=5$, calculate the two values of λ.

2. You are given below the age distribution of a sample of 2280 persons, belonging to a certain region in India. The values of the frequency constants are given.

[illegible]tain (i) the equation of the Pearsonian Curve fitting the distribution (ii) calculate [illegible]ordinates at suitable points and draw the curve.

Age-group	Frequency	Age-group	Frequency
0– 4	271	35–39	117
5– 9	281	40–44	123
10–14	330	45–49	109
15–19	241	50–54	67
20–24	229	55–59	47
25–29	216	60–64	29
30–34	203	65–69	17

$\bar{x} = 22.08$ $\quad \mu_3 = 2501.50$

$s = 15.86$ $\quad \mu_4 = 157041.12$

3. In an irrigation problem on the yield of sugar beets, with 5 treatments A, B, C, D, and E, the following results were obtained from a Latin Square arrangement:

Ton of Beets per acre

Rows \ Columns	1	2	3	4	5
1	18.52(E)	19.40(D)	20.66(A)	22.08(B)	18.65(C)
2	20.08(C)	14.29(E)	18.82(D)	20.02(A)	20.58(B)
3	20.04(A)	17.40(C)	21.06(B)	18.91(E)	20.03(D)
4	22.52(D)	22.98(B)	17.15(E)	17.14(C)	20.62(A)
5	24.44(B)	20.25(A)	18.92(C)	19.73(D)	14.97(E)

Analyse the above experiment. Arrange finally the treatment in a summary form in the order of their efficiency with regard to yield.

4. From the following tables calculate index numbers for different years (1926=100)

Whole-sale Crop prices (Unit = $1.00)

year	corn	wheat	potato	sugar	barley
1923	0.81	1.09	0.95	0.070	0.60
1924	0.96	1.31	0.78	0.060	0.76
1925	1.02	1.59	1.83	0.043	0.78
1926	0.75	1.45	1.42	0.043	0.64
1927	0.86	1.32	1.08	0.047	0.77
1928	0.97	1.18	0.62	0.042	0.78
1929	0.94	1.21	1.36	0.038	0.63

Crop production (in million units)

year	corn	wheat	potato	sugar	barley
1923	3054	707.4	416.1	10044	197.7
1924	2300	864.4	421.6	11552	181.6
1925	2917	676.4	323.5	13527	213.9
1926	2692	831.0	354.3	12952	184.9
1927	2763	799.3	402.7	12540	265.9
1928	2819	914.9	495.4	11517	357.6
1929	2535	812.6	329.1	13820	280.2