

INDIAN STATISTICAL INSTITUTE



QUESTION PAPERS
for
COMPUTER'S CERTIFICATE EXAMINATIONS
May & November 1975

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Price : Rupees Two only

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1975

Paper I (Practical) : Elementary Computation

Time : 5 hours

Full marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is not permitted.

GROUP A

(Attempt all questions from this group)

1. Use contracted method to evaluate any one of the following ; correct to 3 places of decimal :
- (a) 0.047625×42.352 (b) $7.23968 \div 0.8826$ (4)
2. Evaluate any three of the following with the help of suitable formulae :
- (i) $(0.0998)^2$ (iii) $(.2 + .02)(.04 + .0004 - .004)$
- (ii) $\frac{(4.25)^2 - (3.05)^2}{4.30}$ (iv) $(4.5)^3 - (1.5)^3 - 27$ (2x3)=6
- [No credit will be given for working by routine processes.]
3. (i) Round off the following numbers to 3 places of decimal :
- (a) 18.20756 (b) 0.83245
- Find also the absolute and relative errors due to rounding off in each of the above cases.
- (ii) A number rounded off to the nearest integer is 85. Find the limits within which its square must lie. (6x5)=11
4. Answer any two of the following :
- (i) Given $\log_{10} 2 = 0.3010300$ and $\log_{10} 3 = 0.4771213$, find the value of ;
- $$\log_{10} \frac{(10.8)^{1/2} \times (.24)^{5/3}}{(90)^{-2}}$$
- correct to 6 places of decimal.
- (ii) Given $\log_{10} 2 = 0.3010300$ and $\log_{10} 3 = 0.4771213$, find to 2 places of decimal the value of x, from the equation :
- $$6^{3-4x} \cdot 4^{x+5} = 8$$
- (iii) Find the logarithm of $\frac{1}{9}$ to the base $\sqrt{3}$ without using logarithmic table.
- [Note: Use only the information given above and indicate all the steps.] (6x2)=12

Please turn over

5. (a) Using appropriate tables, evaluate the following, correct to 4 places of decimal :
- (i) anti-log of (1.0051) where the base is 10 ;
- (ii) logarithm of (0.04356) where the base is 2 .
- (b) Find the number of digits in $(23)^8$ (3x2+3)=9
6. Evaluate any one of the following, correct to 4 places of decimal,
- (i) $\frac{0.2}{1 \times 2} + \frac{(0.2)^3}{3 \times 4} + \frac{(0.2)^5}{5 \times 6} + \dots$
- (ii) $1 - x + \frac{x^2}{1.2} - \frac{x^3}{1.2.3} + \frac{x^4}{1.2.3.4} - \frac{x^5}{1.2.3.4.5}$ where $x = 0.2$ (6)

GROUP B

(Attempt all questions from this group)

7. Given
- The following table gives the values of a function $f(x)$ for certain values of x :

x	$f(x)$
31	29791
32	32768
33	35937
34	39304
35	42875

Find by linear interpolation, the value of $f(x)$ when $x = 32.45$
 Find also, by linear interpolation the value of x when $f(x) = 37500$ (5+5)

OR

The following table gives the values of a function $f(x, y)$ for different values of x, y ,

y	x		
	10	20	22
11	0.0414	0.0453	0.0492
12	0.0792	0.0828	0.0864
13	0.1139	0.1173	0.1206

Find, by linear interpolation, the value of $f(19.65, 11.90)$

8. Solve graphically any two of the following :
- (a) $3x + 2y = 6$
 $-2x + y^2 = 0$
- (b) $\sin x + \cos 2x = 0.2$ (x lies between 0° and 90°)
- (c) $x - 2 = 3 \log_{10} x$ (try values of x between 2.5 and 4.5)

Please turn over

9. The following table gives the infant-mortality rate (number per thousand) in a country for a number of years during the decade 1936-45. Represent the data in a graph and draw a smooth freehand curve through the plotted points. Hence, estimate the infant mortality rate in the country for the years 1938 and 1946.

year	mortality rate	year	mortality rate
(1)	(2)	(1)	(2)
1936	59	1941	60
1937	58	1942	61
1939	51	1944	45
1940	57	1945	46

(4+2+2)=8

10. Two persons start walking from a place A, and proceed along the same route to reach another place B, which is at least 80 KM away from A. The slower person leaves the place A at 4 a.m. and walks at the rate of 5 KM per hour, while the other leaves A at 8 a.m. on the same day and walks at the rate of 8 KM per hour.

Find graphically

- the time when both the persons meet each other
- the distance between A and the place where they meet each other.

(4+2+2)=8

- 11.

EITHER

Draw the graph of $y = x^2 - 6x + 5$ and find the minimum value of y and the corresponding value of x . Also obtain from the graph the values of x , when

$$(i) x^2 - 6x + 5 = 0 \text{ and } (ii) x^2 - 6x + 5 = 6 \quad (6+3+3)=12$$

OR

Find graphically, the area of the triangle formed by the following intersecting straight lines :

$$y = 8, \quad y = 5x + 3 \quad \text{and} \quad 2x - 3y = 0 \quad (12)$$

NEATNESS (Groups A and B)

(4)

3. The following table shows the coverage of samples in Earners' Survey, in West Bengal during 1962.

After proper scrutiny find out the necessary irregularities and display the correct and wrong figures in a suitable manner considered most appropriate.

(6)

Coverage of Samples in Earners' Survey, 1962,
West Bengal.

Area	Stratum	No. of families allotted	No. of families surveyed	Families not surveyed according to reasons					
				refused to be contacted	could not be contacted	left no trace	other	absent	others
Calcutta		24172	23076	36	121	2	-	-	13
Calcutta Industrial Area	I	3740	3062	1	42	382	230	23	-
	II	2869	2532	6	72	166	47	44	2
	III	5723	4925	14	133	396	183	41	11
	IV	1341	1849	9	52	44	18	54	-
Sub-total		13373	11308	30	299	988	478	162	13
Other Urban Area	A	1116	979	3	17	42	54	10	11
	B	3315	3009	-	4	159	29	2	13
	C	3716	2844	1	8	117	9	4	22
	D	3818	3469	-	15	104	156	4	77
Sub-total		11265	10361	4	44	422	248	27	116
Total Urban Area		48813	45705	94	464	1412	726	182	142
Total Rural Area		124426	123851	4	85	362	-	121	3
West Bengal		173239	169556	98	549	1774	726	303	145

4. Name only the official publications which provide information on the following items. Also mention in each case, the name of the agency issuing the publication, together with the periodicity of the publication.

Attempt any four of the following :

- Annual figures for vessels entered and cleared with cargo and in ballast, in Indian Ports (By steamer and sailing vessels) - in respect of foreign trade only.
- Annual output of educated persons in India by Faculties (Degree & Diploma holders).
- Monthly production of Iron-ore in different States of India in thousand tonnes.
- Annual figures in respect of estimated average daily employment in Government and Local fund factories and in all factories in different States in India.

Please turn over

4. (d) Monthly figures in respect of Post and Telegraph revenue collected under different heads.
 (e) Monthly consumption of cement (despatches) in India.
5. From the official publications placed on the table extract information on the following items:
- i) Present the information in a suitable form for any two available recent dates, months or years as the case may be.
 - ii) Add foot-notes about units, base years etc. when required.
 - iii) Give without fail complete relevant information about the publications consulted by you including page number.]

Attempt any four of the following:

- (a) Number of recognised women colleges in India for any two recent years.
- (b) Number of women employees working under Government in your State, for any two recent years.
- (c) Number of foreign tourists to India excluding tourists from Pakistan for any two recent years.
- (d) Number of permanent post offices in India for any two recent years.
- (e) Number of State Financial Corporations in India for any recent years- stating the date to which it refers.
- (f) Monthly Index Number of Industrial production for tea (manufactured) for any two recent months. (3+3+3)=12

GROUP B

(Attempt all questions from this group)

6. The following crude birth rates and crude death rates were obtained from the Sample Registration Scheme. The rates were worked out for a total population of 1900.

year	crude birth rate	crude death rate
1967	39.4	17.2
1968	39.3	16.8
1969	38.8	19.1
1970	38.9	17.3
1971	38.9	18.4
1972	38.4	18.9

Draw a graph (to a suitable scale) to show the trend in birth and death rates. Indicate also separately the growth rate on the graph, taking the growth rate as the difference of birth and death rates. (11)

Please turn over

7. The table below shows the percentage distribution of males and females in labour force, by different educational standard categories.

educational standard	male	female
1. illiterate	30.25	76.18
2. literate (but below primary)	22.19	7.96
3. primary to below secondary	33.61	7.35
4. secondary	12.74	5.88
5. graduate and above	4.30	2.83

Draw a suitable diagram to compare the two distributions - males and females.

(11)

8. The results of a survey on persons employed are presented in the following table. The table shows for different groups of hours worked, the figures of number of employed, average and total hours worked.

hours worked group	number of employed	average hours worked	total hours worked
1 - 7	65	4	260
8 - 14	77	7	770
15 - 21	70	18	1308
22 - 28	74	25	1480
29 - 35	75	25	2250
36 - 42	90	37	3330
43 - 56	15	48	900

Some mistakes can be detected either in average hours worked or total hours worked. By supposing that whenever one of these figures is wrong, the other must be assumed to be correct. Correct mistakes on this scheme and write the incorrect and correct entries side by side.

(12)

Please turn over

The following table gives the marks in mathematics and physics of 51 students in an examination:

Mathematics	Physics	Mathematics	Physics	Mathematics	Physics
72	95	77	68	78	86
84	96	54	55	97	88
81	92	17	18	66	74
93	97	65	47	41	48
98	98	63	48	52	54
74	73	74	83	76	58
84	79	81	88	67	55
67	63	66	78	88	67
56	48	71	75	73	67
45	58	55	64	48	65
43	50	69	67	93	76
63	87	64	66	85	73
92	87	51	53	88	81
86	77	60	51	82	84
57	60	55	47	73	77
78	76	73	71	88	75
62	65	73	66	68	53

Draw a two-way table showing the frequency distribution of marks in mathematics and physics using appropriate class intervals.

(14)

NEATNESS (Groups A and B)

(4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination, May 1975

Paper III (Practical): Selected Techniques of Computation

Time: 5 hours

Full marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group)

1. Complete the missing entries in the following table:

x	$\frac{1}{x}$	$(x + \frac{1}{x})$	x^3	$\frac{1}{x^3}$	$(x + \frac{1}{x})^3$
(1)	(2)	(3)	(4)	(5)	(6)
10					
5					
2					
-2					
-4					

Total 11

Apply appropriate check on the total of col.(6), using the other column totals.

(9+3)=12

2. The following table gives the values of a function $f(x)$, for different values of x :

x	$f(x)$
2	178.20
3	219.24
4	221.04
5	212.04
6	206.04
7	202.08

Using Newton's Forward formula, obtain the values of $f(x)$ for

(i) $x = 3.3$ and (ii) $x = 1.8$

(4+4)=12

3. EITHER

Using any suitable formula, find $f(323.5)$ in the following table :

x	$f(x)$
321.0	2.50651
322.8	2.50893
324.2	2.51081
325.0	2.51188

(12)

Please turn over

3. OR
(contd.) The following table gives the values of the probability integral $(2/\sqrt{\pi}) \int_0^x e^{-x^2} dx$ corresponding to certain values of x .
For what value of x is this integral equal to $\frac{1}{2}$?

$(2/\sqrt{\pi}) \int_0^x e^{-x^2} dx$	x
0.48465	0.46
0.49374	0.47
0.53275	0.48
0.51167	0.40

Give your answer to four places of decimal. (12)

4. Evaluate $\int_{2.0}^{3.2} x^3 e^{-x} dx$ by (i) trapezoidal rule and
(ii) Simpson's one-third rule, taking at least seven ordinates in each case. - Give your answer to five places of decimal. (4+4+1)=12

GROUP B

(Attempt all questions from this group)

5. The equation $x \log_{10} x - \log_{10} (3-x) = \log_{10} 2$ has its root in the interval (1, 2). Find, by any numerical method the root correct to 4 places of decimal. (16)
6. Solve graphically, correct to one place of decimal, the equations:
(i) $x^2 - 6x + y^2 - 8y = 0$ (ii) $4x - 3y = 1.5$ (12)
7. Evaluate the following determinant by pivotal condensation method, correct to 4 places of decimal:

$$\begin{vmatrix} 3 & 2 & -1 & 1 \\ 1 & -1 & -2 & 4 \\ 2 & 3 & 1 & -2 \\ 5 & -2 & 3 & 2 \end{vmatrix} \quad (8)$$

8. Solve the following system of simultaneous linear equations in x , y and z , correct to two places of decimals:

$$\begin{aligned} 3.15x - 1.96y + 3.85z &= 12.95 \\ 2.13x + 5.12y - 2.89z &= -8.61 \\ 5.92x + 3.05y + 2.15z &= 6.88 \end{aligned} \quad (12)$$

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1975

Paper IV (Practical) : Descriptive Statistics

Time : 3 hours

Full marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group)

1. (a) The lengths (in half minute unit) of intervals between the arrival of 45 successive calls at a certain telephone exchange were observed as follows :

6, 1, 16, 19, 13, 9, 2, 2, 1, 28, 7, 48, 10, 3,
 15, 2, 2, 2, 8, 1, 1, 2, 12, 1, 13, 7, 8, 4, 26,
 15, 3, 3, 5, 9, 8, 11, 43, 18, 1, 1, 31, 5, 14, 10.

Find the mean, median, mode and standard deviation of the above set of observations.

(2+2+1+1)=9

- (b) The cumulative frequency distribution of marks, obtained by 100 students in a certain test is given below. Compute the upper quartile, 6th decile, 70th percentile and the quartile deviation of the distribution.

Marks less than	80	70	60	50	40	30	20	10
Number of students	100	90	80	60	32	20	13	5

$(1\frac{1}{2}+1\frac{1}{2}+1\frac{1}{2}+2\frac{1}{2})=7$

- (c) The coefficients of variation of two sets of observation are 58% and 69%, while their respective standard deviations are 21.2 and 15.6. Find their means. (3)
2. (a) The means standard deviations and the correlation coefficients of annual rainfall (inches) and annual production (maunds per acre) of a crop, based on the records for recent years in an area are given below : The value of the correlation coefficient is 0.8.

	Rainfall (inches)	Production (maunds per acre)
Mean	25	40
Standard deviation	3	8

Estimate, using linear regression, the annual production of the crop in a year when the rainfall is 20 inches. (6)

- (b) Find the regression equation of X on Y and that of Y on X from the following data :

X	10	20	30	40	50	60
Y	15	5	13	25	30	40

Compute also the correlation coefficient of X and Y. (3+3+1)=7

Please turn over

3. The prices of some principal food articles in a town of Eastern India during the year 1961 and during the month of September 1971 are given in the table below. The averages of monthly expenditure per household for these food articles are also given for the year 1961. Using the average expenditures as the weights, compute the weighted average of price-relatives, to show the changes in food prices between the year 1961 and September 1971

Items	average expenditure per household in 1961 (Rs.)	prices per seer in rupees	
		1961	September 1971
(1)	(2)	(3)	(4)
Cereals	53.27	0.55	1.25
Pulses	7.11	3.62	1.90
Edible oils	4.07	3.13	4.23
Vegetables	2.19	0.52	0.68
Milk	4.80	1.25	2.00
Meat and fish	1.41	4.00	5.92
Fruits	0.34	3.21	3.70
Salt	0.56	2.10	0.15
Spices	2.23	3.13	3.90
Sugar	4.46	1.20	2.30

Also compute the geometric mean of the price relatives of all commodities, excluding cereals. (10+0)=16

GROUP B

(Attempt all questions from this group.)

4. A logistic curve was fitted to the data on population (in millions) of a certain country enumerated during 1810 - 1950, at intervals of ten years. The fitted curve is:

$$1/P_t = 0.005272 + 0.18589 (0.7273)^t$$

P_t is the population at time t , and $t = \frac{\text{Year} - 1810}{10}$

The population figures (in millions) of the same country are reproduced below, for the years 1860-1900

year	t	P_t
1860	6	31.44
1870	7	38.56
1880	8	52.16
1890	9	62.05
1900	10	76.70

- (a) Find the trend values of the population for the given years.
 (b) Also plot P_t and the trend values in the same graph. (7+3)=10

Please turn over

5. Fit a curve of the type $y = \alpha + \beta \cdot e^{-x}$ to the data given below by the method of least squares:

x	0.1	0.3	0.5	0.7	0.9
y	1.1348	1.3408	1.6085	1.8966	2.2785

Plot the values of y and corresponding estimated values against x in the same graph. (10+6)=16

6. The following table shows measurements on height and weight made on five pairs of twins of opposite sex, all of 10 years of age:

Height and weight of twins of opposite sex

serial number of twins	male		female	
	height (cm)	weight (kg)	height (cm)	weight (kg)
(1)	(2)	(3)	(4)	(5)
1	136	27.2	132	29.4
2	141	35.0	133	29.0
3	137	33.6	140	27.8
4	137	30.4	135	25.8
5	134	33.4	131	31.2

- (a) Calculate the sample means, variances and covariances for the set of four variables.
- (b) Given that the height and weight of a boy of 10 years are 135 cm and 26.0 kg respectively, obtain an estimate for the height of his twin sister.
- (c) Compute the multiple correlation coefficient of weight of female partner on the height and weight of her twin brother. (12+6+4)=22

NEATNESS (Groups A and B)

(4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1975

Paper V (Practical) : Elementary Statistical Methods

Time : 5 hours

Full Marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A

(Attempt both the questions from this group.)

1. The following table gives the distribution of the "number of successes" obtained in throwing 12 dice 4098 times - a throw ending with 4, 5 or 6 on the uppermost face of a dice being called a success.

number of successes	frequency	number of successes	frequency
0	-	7	847
1	7	8	536
2	09	9	257
3	198	10	71
4	433	11	11
5	731	12	-
6	948	Total	4198

Fit a Binomial distribution to the above data and test for the goodness of fit. (3+10+5)=18

2. Answer any three items from the following :

- (a) i) Weldon threw 12 dice, 26,336 times each, and counting the occurrence of 5 or 6 as a success, obtained in all 136,632 successes. Is this consistent with the hypothesis that the dices are unbiased, that is, the probability of success with a single die is $1/3$?
 ii) The observed frequencies in the four classes of a genetical experiment are 102, 25, 28 and 5 respectively. Examine whether the observed frequencies are in agreement with expected ratios 9:3:3:1. (5+5)=10

- (b) The heart-weights in grams of 12 female and 15 male cats, are given below. Does the heart of a male cat on an average, weigh more than that of a female cat?

Males: 12.7, 15.0, 9.1, 12.8, 8.3, 11.2, 9.4, 8.0, 14.9, 13.7, 13.0, 9.6, 11.7, 9.3, 7.6

Females: 7.4, 7.3, 7.1, 9.3, 7.6, 9.5, 10.1, 10.2, 11.1, 9.5, 8.7, 7.2 (10)

- (c) The means, the sum of squares and the sum of products of the weight in decagrams, x , of a plant and the dry weight, y , of the fibre extracted from the plant, as computed from observations made on 43 jute plants, are given below :

	\bar{x}	\bar{y}
mean	52.775	3.9025
sum of squares (corrected)	3352.975	279.148
sum of products (corrected)		2338.733

- i) Obtain the least square estimates of α and β , where $y = \alpha + \beta x$ is the linear regression equation of Y on X .

- ii) Test whether $\beta = 0$. (2+2+6)=10

2. (d) i) The standard deviations of statures of 273 males and 332 females of a tribe, are found to be 2.85 and 2.38 respectively. Is there any reason to believe that the females are less variable in stature than the males ?

ii) For the data given in Q 2(b) examine whether the standard deviation of heart-weight of male cats is more than 1.5. (5+5)=10

- (e) The following table shows the distribution by colour of hair and colour of eyes, of 8870 persons drawn at random from a certain population. Test whether there is any association between the two attributes, hair-colour and eye-colour.

eye - colour	hair-colour			
	fair	brown	black	red
Blue	1758	877	189	47
Gray	940	1387	740	53
Brown	115	438	288	16

(14)

GROUP B

(Attempt all the questions from this group)

3. (a) Draw a random sample of size 5 (without replacement) from a normal population with mean 57 and variance 13. Compute the sample mean. Indicate the procedure followed by you. (5+2+1)=8
- (b) A rectangular region is bounded by the straight lines $X = 80$, $Y = 90$ and the two coordinate axes. Select 5 points at random from the region, mentioning the coordinates correct to the nearest integer. Describe the procedure followed by you. (5+1)=6

4. EIMER

An experiment on corrosion of zinc was conducted by determining the loss in weight (ounce per square foot) over a full year. Three fixed exposure locations were selected. Two types of zinc were tested. In all, 12 test plates were prepared as shown in the following table.

Type	Loss of zinc (oz per sq. ft.) per year		
	Exposure location		
	A	B	C
T ₁	.337	.137	.561
	.385	.118	.301
T ₂	.332	.398	.950
	.349	.152	.353

- i) Is there any significant difference between the two types ?
- ii) Is there any interaction between type of zinc and exposure location ?

(14)

Please turn over

4. OR
(contd.) Four varieties (A, B, C, D) of oats are being compared for yield. A four-acre plot is selected in 4 localities that differ considerably with respect to soil fertility. Each variety is assigned at random to a one-acre plot in every locality. The yields (measured in a suitable unit) are shown in the following table.

Locality			
I	II	III	IV
A - 33	C - 28	B - 32	A - 44
C - 36	D - 22	C - 47	D - 53
D - 48	A - 46	D - 40	C - 41
B - 13	B - 15	A - 39	B - 26

What conclusion can be drawn concerning the differential yield of the four varieties from the above experimental results? (14)

5. Construct the layout of a randomised block design with 4 treatments and 2 replications. (6)
6. Samples of 50 sheets of book-paper of size 25 inches by 38 inches are tested for sheet formation against a carefully selected standard sheet, so that if the sheet tested has a poorer formation than the standard, it is considered 'defective'. The following table gives the number of defectives in samples of 50 sheets observed on 20 successive days.

day no.	no. of defectives	day no.	no. of defectives
(1)	(2)	(1)	(2)
1	1	11	3
2	0	12	7
3	1	13	3
4	4	14	2
5	1	15	2
6	5	16	3
7	2	17	7
8	1	18	3
9	3	19	3
10	3	20	2

Draw a suitable control chart and comment on the production process. (12+2)=14

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - November 1975

Paper I (Practical) : Elementary Computation

Time : 5 hours

Full marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is not permitted.

GROUP A

(Attempt all questions from this group)

1. Use contracted method to evaluate any one of the following, correct to 3 places of decimal:
- (a) 547.56×0.746234
 (b) $40.860569 \div 0.645432$ (4)
2. Evaluate any three of the following with the help of suitable formulae :
- (i) $(\sqrt{004})^2$ (ii) $(0.5-0.05)(0.25+0.025+0.0025)$
 (iii) $(8.125)^2 - (1.875)^2$ (iv) $(0.54)^3 + (0.46)^3 + 3 \times 0.54 \times 0.46$
 [No credit will be given for working by routine processes.] (2x3)=6
3. 1) Round off the following numbers to 4 significant digits:
 (a) 8.237536 (b) 0.00193426
 Find also the absolute and percentage errors due to rounding off in each of the above cases.
- ii) Find the limits within which the product xy will lie if the values of x and y are 126 and 94 respectively, correct to the nearest integer. (3x2+5)=11
4. 1) Given $\log_{10} 3 = 0.4771213$, find the common logarithm of $\left[(2.7)^3 \times (0.01)^{4/5} \div (90)^{5/4} \right]$, to 6 places of decimal.
- ii) Given $\log_{10} 2 = 0.3010300$, $\log_{10} 3 = 0.4771213$ and $\log_{10} 7 = 0.8450980$, find, correct to 3 places of decimal, the value of x from the equation:

$$21^x = 2^{2x+1} \cdot 5^x$$
- [Note: Only the information given to you should be used. Indicate all the steps of computation.] (6x2)=12
5. (a) Using logarithmic tables, evaluate the following :
- (i) anti-log of (4.38596) where the base is 10, correct to 5 places of decimal;
 (ii) logarithm of 108 to the base 7, correct to 3 places of decimal.
- (b) Find the number of digits in 875^{16} (3x3)=9

Please turn over

6. Evaluate
- any one
- of the following :

(i) $1x^2 + 2x^2 + 3x^2 + \dots + 1(x+1)^2$;

(ii) $\frac{1}{(1+x)(1+2x)} + \frac{1}{(1+2x)(1+3x)} + \frac{1}{(1+3x)(1+4x)} + \frac{1}{(1+4x)(1+5x)}$,

where $x = 0.2$, correct to 2 places of decimal.

(6)

GROUP B(Attempt all questions from this group.)

- 7.
- Either

The following table gives the values of a function $f(x)$ for certain values of x :

x	$f(x)$
53	9.8759
54	9.8629
55	9.8545
56	9.8476
57	9.8361

Find by linear interpolation

(i) the value of $f(x)$ when $x = 54.75$;

(ii) the value of x for which $f(x) = 9.84$.

(5+5)=10

OrThe following table gives the values of a function $f(x,y)$ for different values of (x,y) :

y	x		
	5	10	15
15	0.0828	0.0899	0.0981
16	0.1583	0.1656	0.1724
17	0.2275	0.2343	0.2412

Find, by linear interpolation, the value of $f(10.75, 16.26)$ (10)

8. Draw the graphs of the equations

(i) $y^2 = 6x$ and (ii) $x + y = 0$.

Also find graphically the area bounded by the two graphs.

(4+2+6)=12

9. Solve
- graphically any two
- of the following :

(i) $2x^2 - x - 7 = 0$

(ii) $2x + y = 7.8$

$4x - 5y = 5.8$

(iii) $\sin x = 0.655$ (where x lies between 0 and $\frac{\pi}{2}$)

(5+5)=10

Please turn over

10. The following table shows the values of monthly purchase of a certain commodity during a particular year:

month	purchase (million Rs.)	month	purchase (million Rs.)
January	1782	July	2137
February	1921	August	2272
March	2125	September	2319
April	2275	November	2430
May	1900	December	2492
June	2012		

Represent the data in a graph and draw a smooth free-hand curve through the plotted points. Hence estimate the value of purchase for the month of October in that year. $(4+2+2)=8$

11. Draw the graph of any one of the following :

(i) $y = x^3 + x^2 - 3x - 2$ (taking at least 4 positive and 4 negative values of x between -2 and $+2$);

(ii) $y = e^{-3x}$ (plotting at least 6 points between $x = 0$ and $x = 1$) (9)

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computers' Certificate Examination : November 1975

Paper II - Compilation and Presentation of Statistics (Practical)

Time : 3 hours

Full marks : 100

- (a, Figures in the margin indicate full marks
 (b, Use of Calculating Machines is not permitted)

Group A

(Attempt all questions from this group)

1. The final report on the earners' survey, 1952, in West Bengal conducted by the Bureau of Applied Economics and Statistics, Government of West Bengal, gives the distribution of earners by state of origin (mother tongue) along with their average monthly income from their major occupation and also the average number of earners per family. Major occupation of an earner is defined to be that occupation to which he devotes his maximum time. According to preliminary estimates based on the results of a sub-sample, the number of earners in the State was 10125.1 thousand - this was published in the Interim Report on the Earners' Survey in West Bengal, 1952. The final estimate of the same based on the entire sample surveyed in the State was 9198.75 thousand. Of the total number of earners in the State, 7023.82 thousand (i.e. about 81.26 per cent) were Bengalees, 711.57 thousand (i.e. 7.74 per cent, were Biharies speaking Hindi, 235.58 thousand (i.e. 2.58 per cent), from U.P. with Hindi as mother tongue, 98.73 thousand (i.e. 1.07 per cent), were Oriya, 31.21 thousand (i.e. 0.33 per cent), were South Indians, only 9.01 thousand (i.e. .10 per cent), Marwaris and the rest belonged to other States having other mother tongues.

The average monthly income was highest in the case of Marwari earners viz. 2.193. It was 2.151 in the case of a South Indian earner, while in the case of an Oriya earner it was 2.74. The corresponding figures for 'Hindi-speaking' earners from Bihar and U.P. were 2.85 and 2.87, respectively. The average monthly income of earners in the group of 'other States' having other mother tongues was 2.72. The average monthly income was the lowest in the case of Bengalee earners viz., 2.70. It is observed that the average monthly income of an earner for all mother tongues combined came to 2.72.

The average number of earners per family in the case of Bengalee families was 1.33, for Bihari ('Hindi' families 1.32, for U.P. ('Hindi') families 1.22, for South Indian families 1.23, for 'others' 1.52, and for all mother tongue group as a whole 1.34. The average number of earners per family was the highest in the case of Marwari families, viz., 1.49; it was the lowest in the case of Oriya families, viz., 1.15.

Tabulate the above information in a suitable table giving proper headings.

(10)

(Please turn over)

2. The following table shows the percentage distribution of employed registrants (as on the date of enquiry) according to age, sex and economic status :

Age group (years)	earner			earning dependent			others			total		
	male	female	total	male	female	total	male	female	total	male	female	total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Below 16	-	-	-	0.93	-	0.93	-	-	-	-	-	-
16-20	8.74	6.12	0.86	0.63	-	0.63	-	-	-	0.67	1.12	0.76
21-25	39.55	1.77	4.62	3.43	.17	3.57	0.28	1.43	1.12	43.83	1.28	11.91
26-30	27.45	0.38	27.83	0.93	-	0.93	-	-	-	23.35	1.38	28.73
31-40	13.83	0.47	14.33	0.29	-	0.29	-	0.72	0.2	14.17	0.49	15.06
41-55	2.26	0.50	2.38	-	-	-	-	-	-	2.23	0.12	2.38
56-60	0.00	-	0.00	-	-	-	-	-	-	0.00	-	0.00
61 and above	0.04	-	0.04	-	-	-	-	-	-	0.10	-	0.04
Total	92.01	2.18	94.17	5.52	0.17	5.69	0.28	0.06	0.14	97.61	2.39	100.00

After proper scrutiny find out the irregularities and display the correct and wrong figures in a manner considered most appropriate. (6)

3. From the official publications placed on the table extract information on the following items :

(i) Present the information in a suitable form.

(ii) Add foot-notes about units, base year etc. when required.

(iii) Give complete relevant information about the publication, the agency issuing the publication, and the periodicity of publication.

Attempt any four of the following :

- Total expenditure on "development and maintenance" of roads in India for any recent year.
- Estimated mid-year population of the following countries for any recent year : (i) India, (ii) Japan.
- Total number of workers in India as per latest census under the categories : (a) Cultivators, (b) transport, storage and communication workers.
- Kilowatt hours of electricity sold to ultimate consumers by public electricity undertakings for domestic and commercial purposes during any recent year in India.
- Number of Money Orders issued along with corresponding amounts received during any recent month in India.
- Number of joint stock companies incorporated and registered along with their authorised capital in India for any recent month.

(3x4) = 12

(Please turn over)

4. Give the names of the official publications which provide information on the following items. Also mention in each case, the name of the agency issuing the publication, together with the periodicity of the publication :

Attempt any four of the following

- Monthly absenteeism rates (in percentages) of workers due to sickness, accidents or maternity in cotton mills in different areas of India.
- Annual steel production in UK, USA and West Germany.
- Monthly figures in respect of value of exports (Merchandise) from India and value of imports (Merchandise) to India by commodity group.
- Monthly figures of employment in construction industry in public and private sectors.
- Latest forecast of area (in hectares) under and production (in tonnes) of different cereal crops of India.
- Annual figures in respect of employment in shops and commercial establishments (covered by the Shops and Commercial Establishment Acts) in different states of India.

(5x4) = 12

5. Prepare a blank tabular layout with appropriate headings for presenting the distribution of earners in West Bengal during 1982. The earners will be classified by sex, by age (the age-groups are : below 15 years, 15 - 24, 25 - 50, 50 or more, and by educational standard attained (viz. illiterate, below matriculate, matriculate, graduate, and 'not known'). Provision must be made for recording meaningful totals and sub-totals.

(8)

Group 3

(Attempt all questions from this group)

6. Given below are the estimates of population (in billion) of Rajasthan, for a number of years separately for males and females and also for rural and urban sectors.

year	sector		sex	
	rural	urban	male	female
1971	2116	452	1351	1227
1981	2677	599	1714	1532
1991	3333	77	2138	1937
2001	3956	988	2596	2365

Represent the above data through suitable bar diagrams.

(10)

(Please turn over)

7. The revenues of the Government of India from different sources for a certain year are given below.

source	revenue (in Million Rs.)
1. Customs	10.88
2. Taxes on income (other than Corporation tax)	8.16
3. Corporation tax	3.11
4. Excise (Central)	6.82
5. Others	4.76

Draw a pie diagram for presenting the above data.

(8)

8. The following is a frequency distribution of scores obtained by 140 students in an examination :

score	frequency
319.5 - 339.5	3
299.5 - 319.5	5
279.5 - 299.5	8
259.5 - 279.5	12
239.5 - 259.5	19
219.5 - 239.5	25
199.5 - 219.5	22
179.5 - 199.5	18
159.5 - 179.5	14
139.5 - 159.5	6
119.5 - 139.5	13
99.5 - 119.5	3

Draw the histogram of the above distribution and also the less-than-type ogive.

(7+7) = 14

(Please turn over)

(87)

9. Given below are the total facial lengths (T F L) and the upper facial lengths (U F L) of 40 persons obtained in connection with an anthropometric survey.

serl. no.	T F L (in cm.)	U F L (in cm.)	serl. no.	T F L (in cm.)	U F L (in cm.)
1	131	59	21	120	33
2	115	61	22	117	61
3	122	68	23	114	61
4	111	65	24	125	68
5	116	67	25	112	61
6	111	62	26	118	63
7	125	63	27	116	63
8	118	57	28	117	65
9	117	63	29	117	57
10	117	63	30	125	68
11	114	58	31	113	33
12	110	62	32	117	59
13	112	67	33	116	60
14	110	61	34	114	65
15	112	61	35	115	64
16	111	61	36	119	63
17	115	65	37	110	64
18	114	59	38	114	67
19	120	65	39	117	62
20	120	65	40	110	52

Using appropriate class intervals prepare a two-way frequency table showing the joint distribution of T F L and U F L.

Hence obtain the frequency distribution of T F L taken singly.

(12+1) = 16

Neatness (Groups A and B)

(4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate examination - November 1975

Paper III (Practical): Selected Techniques of Computation

Time: 5 hours

Full marks: 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group.)

1. The following table gives the values of a function $f(x)$ for certain values of x . Using appropriate Newton's formulae find the values of $f(1.45)$ and $f(0.75)$.

<u>x</u>	<u>f(x)</u>
1.0	0.2500
1.1	0.2268
1.2	0.2066
1.3	0.1890
1.4	0.1736
1.5	0.1600

2. Either

Compute the value of π from the formula $\pi = 4 \int_0^1 \frac{dx}{(1+x^2)}$

by (i) Trapezoidal rule

and (ii) Simpson's one-third rule

for quadrature, taking at least 7 ordinates.

Give your answers to 5 places of decimal and compare them with the value of π , viz. 3.14159 (4+4+2)=12

Or

Using the data of the following table compute the int-gral

$$I = \int_4^{5.2} f(x) dx \quad \text{by graphical methods.}$$

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
f(x)	1.38629	1.43508	1.48160	1.52606	1.56862	1.60944	1.64866

(4+2+6)=12

3. The following table gives the values of a function $f(y)$ for different values of y . Find either Bylegrange's formula or by Newton's divided difference formula, the value of y when $f(y)$ is equal to 0.975.

<u>y</u>	<u>f(y)</u>
1.50	.96611
1.55	.97162
1.60	.97635
1.65	.98038
1.70	.98379

(12)

Please turn over

4. Complete the different columns of the following table :

x	y	x-y	x+y	x ²	y ²	x ² -y ²
(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.2	0.09					
-1.7	1.23					
3.5	-2.72					
4.2	1.89					
-2.9	-1.07					

Total:

Apply suitable checks on the totals of cols. (3), (4) and (7).

(9+3)=12

GROUP B

(Attempt any three questions from this group.)

5. Evaluate the following determinant by any method, correct to 3 places of decimal :

$$\begin{vmatrix} 3.2 & 1.2 & -1.3 & 2.0 \\ -5.2 & 1.9 & 3.9 & -4.2 \\ 2.1 & 0.2 & 1.4 & -1.8 \\ 1.4 & -5.2 & 3.1 & -3.3 \end{vmatrix}$$

Also obtain the co-factor of the element in the second row and the third column.

(12+4)=16

6. Solve by the pivotal condensation method the following system of simultaneous linear equations in x, y and z, correct to two places of decimal :

$$0.56x_1 - 0.25x_2 + 0.35x_3 = 0.92$$

$$0.75x_1 + 0.59x_2 - 1.28x_3 = 0.25$$

$$0.48x_1 + 1.29x_2 - 0.86x_3 = 1.79$$

(16)

7. Solve the equation
- $x^2 \sin x = 1.25$
- correct to four places of decimal by any numerical method.

(16)

8. Solve graphically, correct to one place of decimal, the equations :

(i) $y = 3x + 0.5$

(ii) $y = 5e^{-0.1x}$

Try values of x between 0 and 3.

(16)

NEATNESS (Groups A and B)

(4)

Paper IV (Practical) ; Descriptive Statistics

Time : 3 hours

Full marks : 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A(Attempt all questions from this group)

1. A computer, while calculating the mean and the standard deviation of 25 observations, obtained the following values :

mean = 56 inches, standard deviation = 2 inches

It was later discovered at the time of checking that he had wrongly copied down an observation as 64. What would be the mean and the s.d. if this incorrect observation is omitted ? (2+3) = 5

2. An analysis of the monthly wages paid to workers in two firms A and B, belonging to the same industry, gives the following results:

	Firm A	Firm B
Number of wage-earners	686	648
Average monthly wages (₹.)	52.5	47.3
Variance of monthly wages (₹. ²)	100	121

- (a) Which firm, A or B, pays out the larger amount as total monthly wages ?
- (b) In which firm, A or B, is there greater variability in individual wages ?
- (c) Find the mean and the s.d. of monthly wages of all the workers in the two firms A and B taken together. (1+1+1+3) = 6
3. The following shows the age distribution of a certain group of married males covered in a demographic enquiry :

age (no. of completed years)	no. of males	age (no. of completed years)	no. of males
20 - 24	5	45 - 49	21
25 - 29	25	50 - 54	13
30 - 34	32	55 - 59	4
35 - 39	44	60 - 64	1
40 - 44	23	Total :	105

- Find for the above distribution :
- (i) the median,
 (ii) the first and the third quartiles,
 (iii) the sixth decile,
 (iv) the upper 5% point

(2+2+2+2+2) = 10(please turn over)

4. The following shows the distribution of 104 males according to systolic (x) and diastolic (y) blood pressure (in suitable units). Compute the correlation coefficient between the two variates. Also find the regression equations of (i) y on x and (ii) x on y. Find the product of the regression coefficients b_{yx} and b_{xy} .

systolic blood pres- sure (x)	diastolic blood pressure (y)					total
	45.5 - 57.5	57.5 - 69.5	69.5 - 81.5	81.5 - 93.5	93.5 - 105.5	
84.5 - 94.5	7	5	-	-	-	12
94.5 - 104.5	4	27	5	-	-	36
104.5 - 114.5	-	21	58	-	-	79
114.5 - 124.5	-	4	36	6	-	46
124.5 - 134.5	-	-	5	3	-	8
134.5 - 144.5	-	-	-	-	3	3
Total	11	57	104	9	3	184

$$(6+2+2+2) = 14!$$

5. (a) The income of an average middle class family in a certain urban area in India is spent in the following proportions on different groups of items. The consumer price-indices for these item-groups for a war year relative to a certain pre-war period are also given.

item-group	percentage of income spent	price index
Food	48	217
Clothing	13	243
House rent	20	150
Fuel and Light	3	102
Recreation	3	192
Others	10	131

Compute the over-all price index.

(5)

Please turn over

- 6(b). Compute the price index number for 1946 with 1938 as base using Laspeyres' and Paasche's formulae :

commodity no.	quantity (suitable units)		value(in %)	
	1938	1946	1938	1946
1	100	150	60%	90%
2	50	100	32%	60%
3	60	72	15%	36%
4	30	33	36%	20%

Note that value equals price multiplied by quantity. (4+1) = 5

GROUP B

(Attempt all questions from this group)

6. The following table shows the estimated rural population (in million) of a country (on 1st March) during successive years:

year (x)	1952	1953	1954	1955	1956	1957	1958
population(y)	325.2	329.0	313.1	317.3	321.8	326.4	331.3

- (a) Fit a curve of the form $y = A3^x$, finding the expected values.
 (b) Hence estimate the population on 1st March 1961.
 (c) Plot the observed values of y and the corresponding estimated values against year on the same graph paper. (10+3+5) = 18
7. In a study of the factors which influence "academic success" the following results were obtained from the records of 450 students in a university :

	x_1 = honour points	x_2 = general intelligence	x_3 = hours of study per week
means:	$\bar{x}_1 = 18.5$	$\bar{x}_2 = 100.6$	$\bar{x}_3 = 24$
s.d.'s	$s_1 = 11.2$	$s_2 = 15.8$	$s_3 = 6$
correla- tions:	$r_{12} = 0.60$	$r_{13} = 0.32$	$r_{23} = -0.35$

- (i) Find to what extent honour points (x_1) are correlated with general intelligence (x_2), eliminating the influence of hours of study per week (x_3) on them.
 (ii) Find the linear regression equation of x_1 on x_2 and x_3 .
 (iii) Compute the multiple correlation coefficient of x_1 with x_2 and x_3 .

(4+5+4) = 14

8. From the following table showing the bi-monthly receipts of State Governments in India, obtain bi-monthly indices of seasonal variation by the method of moving averages :

Total receipts of State Governments of India (₹.Crores)

year	Jan - Feb.	Mar - April	May - June	July - August	Sept.- Oct.	Nov.- Dec.
1952	82	99	34	37	34	38
1953	81	125	42	44	62	31
1954	68	114	43	50	42	48
1955	74	123	47	53	53	49

NEATNESS (Groups A & B)

(10)
(4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - November 1975

Paper V (Practical) : Elementary Statistical Methods

Time: 5 hours

Full marks: 100

- (a) Figures in the margin indicate full marks.
 (b) Use of calculating machines is permitted.

GROUP A

(Attempt Question No.1 and any four from the rest.)

1. Either

Savages and others measured transparent (in suitable units) of 400 blood cells taken from a patient suffering from primary anaemia. The frequency distribution obtained is given in the following table.

Fit a normal curve to the data and test the goodness of fit.

class interval	frequency	class interval	frequency
(1)	(2)	(1)	(2)
0.6 - 1.5	4	7.6 - 8.5	63
1.6 - 2.5	11	8.6 - 9.5	61
2.6 - 3.5	17	9.6 - 10.5	25
3.6 - 4.5	29	10.6 - 11.5	29
4.6 - 5.5	43	11.6 - 12.5	9
5.6 - 6.5	56	12.6 - 13.5	4
6.6 - 7.5	58		
		total	400

(12+4)=16

Or

The following table gives the distribution of height (x) of 8585 adults in a country, measurements being correct to 1/8th of an inch.

height (x) (in inches)	frequency	height (x) (in inches)	frequency
(1)	(2)	(1)	(2)
57 -	2	68 -	1230
58 -	4	69 -	1063
59 -	14	70 -	646
60 -	41	71 -	392
61 -	83	72 -	202
62 -	169	73 -	79
63 -	394	74 -	32
64 -	669	75 -	16
65 -	990	76 -	5
66 -	1223	77 -	2
67 -	1329		
		Total	8585

Taking $u = (x - 56\frac{7}{16})$, the following moments of u about zero have been found:

$$\mu_2' = 128.0759 \quad \mu_3' = 1557.1436 \quad \mu_4' = 19702.8785.$$

Find the mean, the s.d., β_1 and β_2 of the distribution of height (x), and indicate the type of Pearsonian curve which may fit the data.

(Note that the mid points of the class-intervals are $57\frac{7}{16}$, $58\frac{7}{16}$, etc.)

(12+4)=16

Please turn over
(215)

2. The following results are based on $n = 10$ observation pairs on two variates X and Y :

$$\begin{aligned} \sum X &= 50 & \sum X^2 &= 318 \\ \sum Y &= 52 & \sum Y^2 &= 316 \\ \sum XY &= 321 \end{aligned}$$

Find the linear regression equation of Y on X and test the significance of the regression coefficient. (4+4)=8

3. The frequencies of four genetical classes of offspring were found as follows:

		frequencies
Flat leaves	normal eye	328 /
	Princess	
	Queen eye	
Crippled leaves	Lo's eye	122
	Princess	
	Queen eye	
		77
		33

Test whether the observed frequencies are in conformity with the theoretical proportions $9 : 3 : 3 : 1$. (8)

4. The following table gives the number of persons "attacked" and "not attacked" by typhoid amongst those inoculated and not-inoculated for the disease.

Test whether the attributes are independent.

	number of persons		total
	attacked	not attacked	
inoculated	56	6,759	6,815
not inoculated	272	11,396	11,668
total	328	18,155	18,483

(8)

5. The following are the results based on two random samples of height observation, one for males and the other for females.

$$\begin{aligned} \bar{x}_1 &= 1164 & \bar{x}_2 &= 1456 \\ s_1^2 &= 68.64 & s_2^2 &= 63.87 \\ s_1^2 &= 7.3861 & s_2^2 &= 6.7832 \end{aligned}$$

Test whether \bar{x}_1 is significantly different from \bar{x}_2 . (8)

(All symbols have their usual meanings.)

6. The correlation coefficient of two variates based on a sample of size 20 is found to be $r = -0.629$. Test whether the correlation is statistically significant. (8)

Please turn over

7. The following table gives the additional hours of sleep gained by using two drugs A and B. Test whether the difference between the average effects of the two drugs is significant.

Patient number	Drug A	Drug B	Patient number	Drug A	Drug B
(1)	(2)	(3)	(1)	(2)	(3)
1	+ 0.7	+ 1.9	6	+ 3.4	+ 4.4
2	- 1.6	+ 0.8	7	+ 3.7	+ 5.5
3	- 0.2	+ 1.1	8	+ 0.8	+ 1.6
4	- 1.2	+ 0.1	9	0.0	+ 4.6
5	- 0.1	- 0.1	10	+ 2.0	+ 3.4

(8)

GLCOP B(Attempt all questions from this group.)

8. (a) A triangular region is bounded by the straight line $x+y = 50$ and the two coordinate axes. Select 5 points at random from this region, mentioning the coordinates of the points correct to the nearest integer. Describe the procedure followed by you. (5+2)=7
- (b) The following table gives the frequency distribution of scores of 161 candidates in a certain examination:

Score	Frequency
0 - 10	4
11 - 20	15
21 - 30	32
31 - 40	64
41 - 50	51

Draw a simple random sample of 5 candidates from the above population. Compute the sample mean of the scores. Indicate the procedure followed by you for drawing the sample. (5+1+2)=8

9. Either

The following gives the number of units produced per day by different workmen using 4 different machines. Make an analysis of variance of the data and determine whether there are significant effects (a) of machine types and (b) of workmen on production.

Workmen	Machines Type			
	1	2	3	4
1	44	38	47	36
2	46	40	52	43
3	34	36	44	32
4	43	38	46	33

(8+2+2)=12

Please turn over

9. Or
(contd.)

The following table gives the number of miles travelled by different cars of five makes of automobile, each run on one gallon of a standard gasoline. The numbers of cars observed for the makes A, B, C, D and E were 6, 3, 5, 4 and 4 respectively.

Car no.	Make				
	A	B	C	D	E
1	20.3	19.5	22.1	17.6	23.6
2	19.8	18.6	23.0	18.6	24.5
3	21.6	20.1	20.1	19.5	22.1
4	22.4		21.0	19.2	24.5
5	19.8		22.3		
6	18.6				

Make an analysis of variance of the data and determine whether there is a significant effect of makes. Also examine if E is significantly better than A. (7+3)=12

10. Construct the layout of a Latin Square design with 4 treatments and two replications. (8)
11. Construct a control chart for mean using the following data on the blowing time of fuses (in suitable units), samples of 5 being taken every hour. The standard deviation of the production process is known to be 15. Comment on the state of control of the production process.

Hour	blowing time of 5 fuses				
1st	42	65	75	78	87
2nd	42	45	24	68	72
3rd	90	19	80	81	81
4th	36	54	69	77	84
5th	42	51	57	59	78
6th	51	74	75	78	132
7th	60	60	72	95	138
8th	18	20	27	42	60
9th	15	30	39	62	84
10th	69	109	113	118	153
11th	64	91	93	109	112
12th	61	78	94	109	136

(10+3)=13

MEATLESS (Groups A and B)

(4)

(N10)