

(2) Attempt any four out of remaining six questions.

(3) Use statistical table is permitted.

(4) Figures to the right indicate full marks.

1. (a) When the mean of marks was 50% and S.D. 5% then 60% of the students failed in an examination. Determine the 'grace' marks to be awarded in order to show that 70% of the students passed. Assume that the marks are normally distributed. 5
- (b) Assume that 50% of all engineering students are good in mathematics. Determine the probabilities that among 18 engineering students (i) at east 10 (ii) at least 2 and at most 9 are good in maths. 5
- (c) Fit a straight line to the following data. 5
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|-----|------|------|------|------|------|------|
| x : | 100 | 120 | 140 | 160 | 180 | 200 |
| y : | 0.45 | 0.55 | 0.60 | 0.70 | 0.80 | 0.85 |
- (d) Prove that the coefficient of regression are independent of change of origin but not of change of scale 5

2. (a) Find the m.g.f. of a random variable x if the r^{th} moment about of origin is given by $\mu_r^1 = r!$. Also find mean and variance. 6

- (b) A random variable x has the following probability function 6

x :	1	2	3	4	5	6	7
P(x) :	k	2k	3k	k^2	$k^2 + k$	$2k^2$	$4k^2$

find (i) k (ii) $p(x < 5)$ (iii) $p(x > 5)$ (iv) $p(0 \leq x \leq 5)$

- (c) Using the method of lagrange's multipliers solve the N.L.p.p. 8

$$\text{Optimize } z = 12x_1 + 8x_2 + 6x_3 - x_1^2 - x_2^2 - x_3^2 - 23$$

$$\text{subject to } x_1 + x_2 + x_3 = 10, \quad x_1, x_2, x_3 \geq 0$$

3. (a) Obtain the relative maximum or minimum (if any) of the function 6

$$z = x_1x_2 + 9x_1 + 6x_3 - x_1^2 - x_2^2 - x_3^2$$

- (b) Test for goodness of fit of a poisson distribution at 0.05 LOS to the following frequency distributions 6

No.of patients arriving/hour (x)	0	1	2	3	4	5	6	7	8
Frequency	52	151	130	102	45	12	5	1	2

- (c) Using kuhn - Tucker conditions solve the following N.L.p.p. 8

$$\text{maximize } z = 2x_1 + 3x_2 - x_1^2 - x_2^2$$

$$\text{subject to } x_1 + x_2 \leq 1, \quad 2x_1 + 3x_2 \leq 6 \quad x_1, x_2 \geq 0$$

4. (a) Show that in a poisson distribution with unit mean, the mean deviation about the mean is $\frac{2}{e}$ times the standard deviation. 6

- (b) If \bar{x} is the mean of a random sample of size n taken from a population of size N having the mean μ and variance σ^2 then the mean of \bar{x} is μ and the variance of \bar{x} is σ^2/n . 6

- (c) Use Penalty (or Big M) method to 8
 Maximize $z = x_1 + 2x_2 + 3x_3 - x_4$
 Subject to the constraints
 $x_1 + 2x_2 + 3x_3 = 15$
 $2x_1 + x_2 + 5x_3 = 20$
 $x_1 + 2x_2 + x_3 + x_4 = 10$
 $x_1, x_2, x_3 \geq 0, x_4 \geq 0$
- 5 (a) Use dual simplex method to solve the L.p.p. 6
 Minimize $z = 3x_1 + 2x_2 + x_3 + 4x_4$
 Subject to the constraints
 $2x_1 + 4x_2 + 5x_3 + x_4 \geq 10$
 $3x_1 - x_2 + 7x_3 - 2x_4 \geq 2$
 $5x_1 + 2x_2 + x_3 + 6x_4 \geq 15$
 $x_1, x_2, x_3, x_4 \geq 0$
- (b) A normal population has a mean of 0.1 and S.D. of 2.1. Find the probability that the mean of a sample size 900 drawn from this population will be negative. 6
- (c) The equation of the two lines of regression for a bivariate data are 8
 $9x + 10y - 67 = 0$ and $5x + 2y - 23 = 0$
 Find 1) mean values of x and y
 2) regression coefficient
 3) correlation coefficient
6. (a) Find all the basic feasible solution of the equation 6
 $2x_1 + 6x_2 + 2x_3 + x_4 = 3$
 $6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$
- (b) From the following data Calculate spearman's rank correlation between x and y 6
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|----|----|----|----|----|----|----|----|----|----|
| x: | 36 | 56 | 20 | 42 | 33 | 44 | 50 | 15 | 60 |
| y: | 50 | 35 | 70 | 58 | 75 | 60 | 45 | 80 | 38 |
- (c) The nicotine contrasts in two random samples of lobacc are given below 6
- | | | | | | | |
|-----------|----|----|----|----|----|----|
| sample 1: | 21 | 24 | 25 | 26 | 27 | -- |
| sample 2: | 22 | 27 | 28 | 30 | 31 | 36 |
- can you say that the two samples came from the same population.
- (d) Give any two uses of .t. distribution 2
7. (a) Two populations have the same, mean but the S.D. of one is twice that of the other. Show that in samples, each of size 500, drawn under simple random condition the difference of the means will, in all probability, not exceed 0.3σ where σ is the smaller S.D. 6
- (b) A communication system consists of n components, each of which will independently function with probability p. The total system will be able to operate effectively if at least one half of its component function. for what values of p is 5 component system more likely to operate effectively than 3 component system ? 6
- (c) Show that in a normal distribution, mean median are equal. 8