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Total Number of Pages : 03

M.Tech
PDPC103

1st Semester Back Examination 2019-20
QUANTITATIVE TECHNIQUES IN PRODUCTION MANAGEMENT
BRANCH : MECH. ENGG., PRODUCTION ENGG, PRODUCTION ENGG AND
OPERATIONAL MGT

Time : 3 Hours

Max Marks : 70

Q.CODE : HB660

Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks.

- Q1** **Answer the following questions :** **(2 x 10)**
- a) Distinguish between independent variable, dependent variable and intervening variable.
 - b) Write the difference between Null and Alternate hypothesis.
 - c) Distinguish between Type-I error with respect to Null hypothesis.
 - d) Write the relationship between mean, median and mode.
 - e) Explain the terms "Decision Variable", "Objective Function" and "Constraints" in LP problem
 - f) Explain the terms 'Basic Variable' and 'Non Basic Variable'
 - g) What is Sensitivity Analysis in Linear Programming Problem.
 - h) Write the dual problem of following LP problem.
Maximize $5x_1 + 6x_2$
Subject to $2x_1 + x_2 \leq 30$
 $3x_1 + 4x_2 \leq 50$
 $4x_1 + 5x_2 \leq 80$
 - i) The customers' specification for certain critical dimension is $(2.5 \pm 0.15)\text{cm}$. If for this dimension, the mean and standard deviation of a lot is 2.5cm and 0.05cm respectively, what fraction of product is likely to be rejected?
 - j) List any four commonly used sampling distributions.
- Q2** a) For a certain acceptance sampling plan, a sample of 20 pieces is picked up from a lot that has 3% defective items. What is the probability that number of defective items in the sample is not more than 1? **(5)**
- b) The following table shows the mean weight in kilograms of members of a group of young children of various ages. **(5)**
- | | | | | | |
|---------------|-----|-----|-----|-----|-----|
| Age (x years) | 1.6 | 2.5 | 3.3 | 4.4 | 5.6 |
| Weight (y kg) | 12 | 15 | 16 | 17 | 20 |
- The relationship between the variables is modelled by the regression line with equation $y=ax+b$
- (a) Find the value of a and b
 - (b) Write down the correlation coefficient.
 - (c) Estimate the mean weight of a child that is four years old.
- Q3** a) The average arrival rate of customers to a service counter is 4 per hour. Assuming arrival pattern of customers follow Poisson distribution, determine the **(5)**

following probabilities.

- a) Probability that the number of arrivals in an hour is 3 or more but less than 7.
 - b) Probability that no customer turns up in a particular hour.
 - c) Probability that the time duration between two successive arrivals is less than 20 minutes.
- b) Explain the relationship between Poisson distribution and Exponential distribution. (5)

Q4 a) Show how transportation problem can be expressed as a LP problem. (5)

- b) A steel company has three open – hearth furnaces and five rolling mills. Transportation costs (rupees per quintals) for shipping steel from furnaces to rolling mills are shown in following table. Find the initial solution by using Vogel Approximation method (5)

Furnaces	Mills					Supply
	M1	M2	M3	M4	M5	
F1	4	2	3	2	6	8
F2	5	4	5	2	1	12
F3	6	5	4	7	7	14
Demand	4	4	6	8	8	

Q5 a) Solve Linear Programming problem by Simplex method (5)

Maximise $3x_1 + 2x_2$

Subject to:

$$2x_1 + x_2 \leq 2$$

$$3x_1 + 4x_2 \geq 12$$

$$x_1, x_2 \geq 0$$

- b) Cost of production of jobs in different machines is given in cost matrix given below. (5)

		MACHINES				
		M1	M2	M3	M4	M5
J O B S	A	25	15	15	25	20
	B	15	20	15	25	35
	C	10	25	25	15	20
	D	15	15	10	30	15
	E	20	10	5	0	20

Solve the assignment problem to assign each job to a machine for minimisation of costs.

Q6 A machine shop is producing three components C1, C2 and C3 at a profit of Rs.1000/_, Rs.1200 and Rs.1600/_ per unit respectively. Each component is required to be processed in three types of machine M1, M2 and M3. The processing time required for each component is given in table given below. (10)

Component	Machine M1	Machine M2	Machine M3
Components C1	4	2	8
Components C2	6	8	6
Components C3	8	12	2

Machine hour available per week for each machine is 220 hours. How much of each component should be produced for maximum profit? Formulate the LP problem.

Q7

A die is thrown 132 times. The results are as follows:

(10)

Number turned up	1	2	3	4	5	6
Frequency:	22	19	24	14	27	26

Apply the chi - square test to find whether the die is unbiased or not. Critical Chi-square values for p-value of 0.05 are given below.

Df	1	2	3	4	5	6	7	8
X^2_{Critical}	3.84	5.99	7.81	9.49	11.07	12.55	14.07	15.51

Q8**Write short Notes on any TWO :****(5 x 2)**

- a) Testing of Hypothesis
- b) Factor Analysis
- c) Regression Analysis