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Roll No .....

METE-101

M.E/M.Tech. I Semester

Examination, June 2017

System Mathematics and Mathematical Modelling

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Use graphical method to solve the L.P.P.

Maximize $Z = 2x_1 + 4x_2$

Subject to constraints:

$x_1 + 2x_2 \le 5,\ x_1 + x_2 \le 4$

$x_1, x_2 \ge 0$

b) Use Simplex method to

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to constraints:

$x_1 + 2x_2 + x_3 \le 430$

$3x_1 + 2x_3 \le 460$

$x_1 + 4x_3 \le 420$

$x_1, x_2, x_3 \ge 0$

2. a) Solve the following transportation problem:

	To			
	A	B	C	Available
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Demand	6	10	15	

b) Solve the following assignment problem

	A	B	C	D
1	10	25	15	20
2	15	30	5	15
3	35	20	12	24
4	17	25	24	20

3. a) A small project consists of seven activities for which the relevant data are given below:

Activity	Preceding activities	Activity duration (days)
A	--	4
B	--	7
C	--	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

i) Draw the network and find the project completion time.
ii) Calculate total float for each of the activities.

b) Explain the following terms used in PERT
i) Pessimistic time
ii) Optimistic time
iii) Most likely time
iv) Probability of meeting the schedule time.

4. a) Use dynamic programming to solve the following problem:

Minimize $Z \quad y_1^2 + y_2^2 + y_3^2$

Subject to constraints:

$y_1 + y_2 + y_3 \ge 15$

$y_1, y_2, y_3 \ge 0$

b) Solve the following non-linear programming problem

Optimize $Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

Subject to constraints:

$$x_1 + x_2 + x_3 = 15$$

$$2x_1 - x_2 + 2x_3 = 20$$

5. a) Write short notes on the following:
   i) **Queueing system**
   ii) **Elements of queueing system**
   iii) Operating characteristics of queueing system

   b) **Solve the game whose payoff matrix is given by**

		Player B				
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	9	3	1	8	0
	A_2	6	5	4	6	7
	A_3	2	4	3	3	8
	A_4	5	6	2	2	1

6. a) **A T.V. repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day. What is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?**

   b) Find the mean and variance for Poisson distribution.

7. a) A banker claims that the life of a regular savings account opened with his bank averages 15 months with an S.D. of 6.45 months. Assuming that life of a regular savings account is normally distributed, find what is the probability that
   i) There is balance in the savings account of a depositor at the end of 19 months.

   ii) The savings account of a depositor will have been closed before 21 months.

b) Let P be the probability that a coin will fall head in a single toss in order to test $H_0 : P = P_0 = \frac{1}{2}$ against $H_1 : P = P_1 = \frac{3}{4}$. The coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Find the probability of type I error and power function.

a) Explain the following in connection with reliability
   i) Quality and reliability
   ii) System reliability
   iii) Measures of reliability

b) It is desired to have reliability of atleast 0.990 for a specified service period of 8,000 hours on the assumption of a uniform failure rate. What is the least value of θ that will yield this desired reliability?

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