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10ME74

Seventh Semester B.E. Degree Examination, Dec.2017/Jan.2018
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of normal distribution tables is permitted.***

PART – A

1 a. Define operations research. Give the historical development of operations research. **(06 Marks)**

b. A farmer has 100 acre land. He can sell all the tomatoes, lettuce or radishes that he can raise. The price he can obtain is ₹ 10/- per kg of tomatoes, ₹ 7/- a head of lettuce and ₹ 10/- per kg of radishes. The average yield per acre is 2000 kg of tomatoes, 3000 heads of lettuce and 1000 kg of radishes. Labour required for Sowins, Cultivating and harwesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man-days of labour is available at ₹ 100/- per man day. Formulae this problem as LPP to maximize the farmer's profit. **(08 Marks)**

c. Define the following terms with reference to LPP:
(i) Feasible solution. (ii) Infeasible solution. (iii) Unbounded solution. **(06 Marks)**

2 a. Explain the concepts of degeneracy in simplex method. **(05 Marks)**

b. Solve the following LPP using simplex method,

$$z_{min} = x_1 - 3x_2 + 2x_3$$

Subject to: $3x_1 - x_2 + 2x_3 \le 7$

$$-2x_1 + 4x_2 \le 12$$

$$-4x_1 + 3x_2 + 8x_3 \le 10$$

$$x_1, x_2, x_3 \ge 0$$

(15 Marks)

3 a. Larsen and Toubro company needs 3, 3, 4 and 5 million cubic feet of fill at four earthen dam sites I, II, III and IV in Karnataka. It can transfer the fill from three mounds A, B, C where 2, 6, 7 million cubic feet of fill is available respectively. Costs of transportation of one million cubic feet of fill from mounds to the four sites in lakhs of rupees are given in the following table.

		To I	II	III	IV
From	A	15	10	17	18
	B	16	13	12	13
	C	12	17	20	11

Determine the optimal transportation plan which minimizes the total transportation cost to the company. **(12 Marks)**

b. A batch of 4 jobs can be assigned to 5 different machines. The following table shows the installation time in hours for each job on various machines. Find the optimal assignment of jobs to machines which will minimize the total installation time. **(08 Marks)**

		Machine M_1	M_2	M_3	M_4	M_5
Job	J_1	10	11	4	2	8
	J_2	7	11	10	14	12
	J_3	5	6	9	12	14
	J_4	13	15	11	10	7

4 a. What is an integer programming problem? Explain the importance of integer programming. **(05 Marks)**

b. Use branch and bound method to solve the following integer programming problem.

$Z_{max} = 7x_1 + 9x_2$

Subject to,

$-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7$

$x_1, x_2 \geq 0$ and are integers. **(15 Marks)**

PART – B

5 a. Explain the basic steps involved in PERT/CPM. **(04 Marks)**

b. Write short notes on crashing of a project network. **(04 Marks)**

c. An organization has large number of activities but it is interested in controlling a part of these activities to 7 in number. The following data is available for these activities.

Activity	Precedence	Time (days)		
		t_0	t_m	t_p
A	-	4	6	8
B	A	6	10	14
C	A	8	15	22
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

(i) Draw a PERT network for the activities.

(ii) Identify the critical path and its duration.

(iii) If the organization puts 47 days as dead line to complete, what is the probability of completion in 47 days. **(12 Marks)**

6 a. Define the term queue. State and explain the characteristics of queing system. **(08 Marks)**

b. Patrons arrive at a reception counter at an average inter arrival time of 2 minutes. The receptionist on duty takes an average of one minute per person. (Arrivals are as per exponential and services are as per Poisson distribution).

(i) What is the probability that a person will straight away meet the receptionist?

(ii) For what portion of the time the receptionist is busy?

(iii) What is the average queue length?

(iv) What is the average number of patrons in the system?

(v) What is the average waiting time of a patron?

(vi) What is the average time a patron spends in the system? **(12 Marks)**

7 a. Explain the following terms related to theory of games:

(i) Pay-off matrix.

(ii) Min.Max and Max.Min principle.

(iii) Dominance rule.

(iv) Pure and mixed strategies.

(v) Fair game. **(10 Marks)**

b. Use the dominance rule and solve the following game whose pay.off matrix for player A is:

		B		
		B_1	B_2	B_3
A	A_1	-4	6	3
	A_2	-3	-3	4
	A_3	2	-3	4

(10 Marks)

8 a. List out any four assumptions underlying sequencing problems. **(04 Marks)**

b. Consider the processing times (in minutes) of 5 jobs each of which must undergo through 2 machines M_1 and M_2 in the order M_1M_2.

		Job				
		J_1	J_2	J_3	J_4	J_5
Machine	M_1	5	1	9	3	10
	M_2	2	6	7	8	4

Obtain the sequence for the jobs that minimizes the total elapsed time and also find the idle time of both the machines. **(08 Marks)**

c. There are five jobs, each of which is to be processed through machines A, B and C in the order CAB, processing time in hours is given below:

		Machine		
		A	B	C
Job	1	4	7	3
	2	5	9	8
	3	1	5	7
	4	2	6	5
	5	3	10	4

Determine the optimum sequence for the jobs and the total elapsed time. **(08 Marks)**

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