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06ME74

Seventh Semester B.E. Degree Examination, June/July 2016

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 statistical tables is permitted.***

PART – A

1 a. What are the various phases of O.R problems? Explain them briefly. **(05 Marks)**

b. Explain the applications of O.R in industry. **(05 Marks)**

c. A company has three operational departments (weaving processing and packing) with capacity to produce three different types of clothes namely suiting, shirting and woolens yielding a profit of Rs 2, Rs 4 and Rs 3 per metre respectively. One metre of suiting requires 3 minutes in weaving, 2 minute in processing and 1 minutes in packing. Similiarly one metre of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing. one metre of woolen requires 3 minutes in each department. In a week, total run time of each department is 60, 40 and 80 hours for weaving, processing and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit. **(10 Marks)**

2 a. A company is manufacturing two products A and B. The manufacturing time required to make them the profit per unit and capacity available at each work centre are as follows.

Product	Machining Time (hrs)	Fabrication (hrs)	Assembly time	Profit per unit
A	01	03	05	80
B	02	01	04	100
Total capacity	720	1800	900	

Convert the above problem into a mathematical model. Formulate the dual of the problem and state its merits. **(06 Marks)**

b. Solve the following problem by two phase method

Minimize $Z = 4x_1 + 2x_2$

Subject to $3x_1 + x_2 \geq 27$

$x_1 + x_2 \geq 21$

$x_1, x_2 \geq 0$

(14 Marks)

3 a. With respect to transportation problems, what is degeneracy and how is it tackled? **(05 Marks)**

b. A company has three plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively unit transportation costs are given below. Determine optimal distribution for the company in order to minimize the total transportation cost

		To				
		D	E	F	G	H
From	A	5	8	6	6	3
	B	4	7	7	6	5
	C	8	4	6	6	4

(15 Marks)

4 a. A salesman must travel from city to city to maintain his accounts. This week he has to leave his home base and visit each other city and return home. The table shows the distances (in kilometers) between the various cities The home city is city A. Use the assignment method to determine the tour that will minimize total distances of visiting all cities and returning home.

	To city				
From city	A	B	C	D	E
A	-	375	600	150	190
B	375	-	300	350	175
C	600	300	-	350	500
D	160	350	350	-	300
E	190	175	500	300	-

(10 Marks)

b. The time spent (in minute) in processing of two jobs on six machines. A, B, C, D, E and F and the necessary technological ordering of machines are as follows.

Job 1 :	A – 20,	C – 10,	D – 10,	B – 30,	E – 25,	F – 15
Job 2 :	A – 10,	C – 10,	E – 15,	D – 10,	F – 15,	B – 20

Use graphical method to determine an optimal sequence of jobs which minimizes the total elapsed time, also determine which job is done first on each of the machines. **(10 Marks)**

PART – B

5 a. An R and D activity has 7 activities for which the three time estimates are given below along with its preceding activities.

Activity	Preceding activity	Optimistic time	Most likely time	Pessimistic time
A	None	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

i) Draw the PERT network
ii) Find EST, LST and slack for each node
iii) Find critical path.

(08 Marks)

b. The following table gives data on normal time, cost and crash time cost for a project.

Activity	Normal		Crash	
	Time (days)	Cost (Rs)	Time (days)	Cost (Rs)
1 – 2	6	600	4	1000
1 – 3	4	600	2	2000
2 – 4	5	500	3	1500
2 – 5	3	450	1	650
3 – 4	6	900	4	2000
4 – 6	8	800	4	3000
5 – 6	4	400	2	1000
6 – 7	3	450	2	800

The indirect cost per day is Rs 100

i) Draw the network and identity the critical path
ii) What are the normal project duration and associated cost?
iii) Crash the relevant activities systematically and determine the optimum project completion time and cost.

(12 Marks)

6 a. Explain the Fulkerson's rule of numbering the nodes. **(06 Marks)**

b. State the basic elements of a queuing model. **(04 Marks)**

c. A box office ticket window is being manned by a single server. Customers arrive to purchase tickets according to a poisons input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 90 seconds. Calculate,

i) Mean queue length, L ii) Mean line length, L_q iii) Mean waiting time in the system, W iv) Mean waiting time in the line W_q. **(10 Marks)**

7 a. Explain the terms : i) saddle point ii) Pay off matrix. **(04 Marks)**

b. An engineering student was frequently absent to the classes in a semester. To safe guard himself, he can choose one of the alternatives given below and the professor also had four strategies. The student has approximated the probable percent of marks in the following pay off matrix against various strategies.

The students strategies are showing reasons as

S_1 : due to ill health S_2 : to attend sisters marriage

S_3 : went on project work S_4 : attended intercollege celebrations.

The professors strategies are

P_1 : Not giving attendance P_2 : Giving exam tough

P_3 : evaluating strictly P_4 : complaining to principal

The pay of is

	P_1	P_2	P_3	P_4
S_1	55	53	32	62
S_2	40	30	74	50
S_3	57	54	44	53
S_4	54	54	72	56

Use dominance principle so that the student may choose his optimal strategy. **(06 Marks)**

c. Solve the following game graphically

$$A \begin{matrix} \\ 1 \\ 2 \end{matrix} \begin{matrix} \begin{matrix} B \\ 1 \quad 2 \quad 3 \quad 4 \end{matrix} \\ \begin{bmatrix} -6 & 0 & 6 & -3/2 \\ 7 & -3 & -8 & 2 \end{bmatrix} \end{matrix}$$

(10 Marks)

8 a. Explain how Gomory's cutting plane algorithm works **(05 Marks)**

b. Solve the following integer programming problem using Gomory's cutting plane algorithm.

Maximize $Z = x_1 + x_2$

Subject to the constraints

$$3x_1 + 2x_2 \leq 5$$

$$x_2 \leq 2$$

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

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