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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; June - 2017

Operations Research

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Discuss the nature of operations research. 8

b. A student has two final exams to prepare. For each hour of study he devotes to course A, he expected to return him Rs. 600, in terms of long range benefits and each hour of study he devotes to course B is expected to return Rs. 300, in terms of long range benefits. The shops are closed. The student has only 15 chocolates remaining. He feels he needs 1 chocolate every 20 minutes while studying for course B and 1 every 12 minutes while studying for course A. It is necessary that the student must devote at least 2 hours for study. The student would like to maximize his return for the effort expended. Formulate this problem as an LPP. 6

c. Solve graphically :

Minimize $Z = 3x_1+2x_2$

Subject to constraints: $5x_1+x_2 \geq 10$, $x_1+x_2 \geq 6$, $x_1+4x_2 \geq 12$ and $x_1, x_2 \geq 0$. 6

2 a. Solve the following LP problem using the Simplex method :

Maximize $Z = 7x_1+5x_2$

Subject to constraints: $-x_1- 2x_2 \geq -6$, $4x_1+3x_2 \leq 12$ and $x_1, x_2 \geq 0$. 10

b. Solve the following LPP by Big-M method :

Maximize $Z = 6x_1+4x_2$

Subject to $2x_1+3x_2 \leq 30$, $3x_1+2x_2 \leq 24$, $x_1+x_2 \geq 3$ and $x_1, x_2 \geq 0$. 10

UNIT - II

3 a. Explain the concept of duality of linear programming. 10

b. Write the dual of the following LP problem :

Minimize $Z = 3x_1-2x_2+4x_3$

Subject to $3x_1+5x_2+4x_3 \geq 7$, $6x_1+x_2+3x_3 \geq 4$, $7x_1-2x_2-x_3 \leq 10$,

$x_1-2x_2+5x_3 \geq 3$, $4x_1+7x_2-2x_3 \geq 2$ and $x_1, x_2, x_3 \geq 0$. 10

4 a. The transportation cost per truck load of cement (in hundreds of rupees) from each plant to each product site are as follows:

Contd 2…

Factories	Project sites				Supply
	1	2	3	4	
1	2	3	11	7	6
2	1	0	6	1	1
3	5	8	15	9	10
Demand	7	5	3	2	

12

Determine the optimal distribution for the company, so as to minimize the total transportation cost.

b. A car hire company has one car at each of 5 depots *a*, *b*, *c*, *d* and *e*. A customer requires a car in each town namely, A, B, C, D and E. Distance (in kms) between depots (origins) and towns (destinations) are given in the following distance matrix.

Towns	Depots				
	a	*b*	*c*	*d*	*e*
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

8

How cars should be assigned, so as to minimize the distance travelled?

UNIT - III

5 a. Define the following with reference to networks :

i) Node ii) Arc iii) Path

iv) Spanning tree v) Connected network. 10

b. For the network shown in Fig. 5b, determine under which roads telephone lines should be installed to connect all stations with a minimum total length of line in miles.

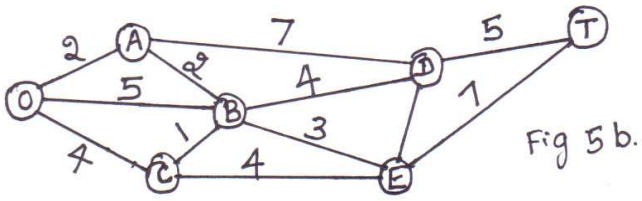

Fig 5b.

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6 a. The network in Fig. 6a, shows the permissible rates and their lengths in miles between city 1 (node 1) and four other cities (Nodes 2 to 5). Determine the shortest routes between city 1 and each of the remain four cities.

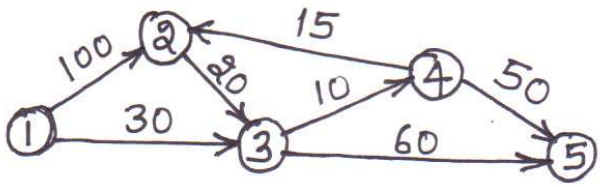

Fig 6.a

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

Activity	Normal		Crash	
	Time (weeks)	Cost (Rs.)	Time (weeks)	Cost (Rs.)
1 – 2	3	300	2	400
2 – 3	3	30	3	30
2 – 4	7	420	5	580
2 – 5	9	720	7	810
3 – 5	5	250	4	300
4 – 5	0	0	0	0
5 – 6	6	320	4	410
6 – 7	4	400	3	470
6 – 8	13	780	10	900
7 – 8	10	1000	9	1200

10

Indirect cost is Rs. 50 per week.

i) Draw the network diagram for the project and identify the critical path.

ii) What are the normal project duration and associated cost?

UNIT - IV

7 a. Explain the structure of a queuing system. 10

b. Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially with mean 3 minutes,

i) What is the probability that a person arriving at the booth will have to wait?

ii) The telephone department will install a second booth when convinced that an arrival would expect waiting for at least 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth? 10

iii) What is the average length of the queue that forms from time to time?

iv) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call?

8 a. Explain birth death process and its significance in queuing. 10

b. A shipping company has a single unloading dock with ships arriving in a Poisson fashion at an average rate of 3/day. The unloading time distribution for a ship with '*n*' unloading crews is found to be exponential with average unloading time 1/2n days. The company has a large labour supply without regular working hours, and to avoid long waiting times, the company has a policy of using as many unloading crews as there are ships waiting in line or being unloaded. Find : 10

Contd 4...

i) The average number of unloading crews working at any time

ii) The probability that more than 4 crews will be needed.

UNIT - V

9 a. Discuss the distinguishing characteristics of dynamic programming. 8

b. Use dynamic programming to solve the following LPP :

Maximize $Z = 3x_1+5x_2$, subject to $x_1 \leq 4$, $x_2 \leq 6$, $3x_1+2x_2 \leq 18$, and $x_1, x_2 \geq 0$. 12

10 a. Define the following :

i) Player ii) Pay off iii) Strategy 10

iv) Two person zero sum game v) Value of the game.

b. Solve the following game by dominance principles.

Player A	Player B			
	I	II	III	IV
I	6	8	3	13
II	4	1	5	3
III	8	10	4	12
IV	3	6	7	12

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