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

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Semester End Examination; June/July - 2015

Operations Research

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each **part**.*
ii) Missing data may be suitably assumed.

PART - A

1. a. Explain 4 distinct types of validations in O.R. study. 4

b. Solve by using graphical method.

Maximize $Z = 10x_1 + 20x_2$

subject to $-x_1 + 2x_2 \le 15$

$x_1 + x_2 \le 12$

$5x_1 + 3x_2 \le 45$ and $x_1, x_2 \ge 0$ 8

c. Formulate a linear programming model for the below problem.

Company X produce 2 products which require metal frame parts and electric components. Determine how many units of each product to produce to maximize profit for each unit of product 1. One unit of frame part and 2 units of electrical components are required. For each units of electrical components are required company has 200 units of electrical components are required company has 200 units of frame parts and 300 units of electrical components. Each unit of product 1 give profit of each unit of product 2 upto 60 units give profit of any excess over 60 units brings no profits. 8

2 a. Explain six key solution concepts of solving simplex method. 10

b. Solve using Big M method:

Minimize $z = 2x_1 + 3x_2$

$x_1 + x_2 \ge 6$

$7x_1 + x_2 \ge 14$ x_1 and $x_2 \ge 0$ 10

3 a. Explain primal-Dual relationship for all primal forms. 8

b. Solve the given linear programming problem using the results of its dual problem.

Minimize $Z_1 = 24x_1 + 30x_2$

subjected to $2x_1 + 3x_2 \ge 10$

$4x_1 + 9x_2 \ge 15$

$6x_1 + 6x_2 \ge 20$ x_1 and $x_2 \ge 0$ 12

Contd…2

4. a. Explain Hungariyan algorithms with step followed. 8

b. Consider the transportation problem shown in table 4.1

Find the initial basic feasible solution using

i) North West Corner Rule

ii) Vogel's approximation method.

Compare their total costs

Table 4.1 12

		Market					
		1	2	3	4	5	Supply
Plant	1	10	2	16	14	10	300
	2	6	18	12	13	16	500
	3	8	4	14	12	10	825
	4	14	22	20	8	18	375
Demand		350	400	250	150	400	

PART - B

5 a. Find the minimum spanning tree and find shortest path between nodes T to S and P to M

Given the distance matrix as below (Table 5(a)

Nodes

Nodes		P	W	M	S	T
	P	-	7.1	19.5	19.1	25.7
	W	7.1	-	8.3	16.2	13.2
	M	19.5	8.3	-	18.1	5.2
	S	19.1	16.2	18.1	-	17.2
	T	25.7	13.2	5.2	17.2	-

10

b. Find the maximum flow between node 1 to 5.

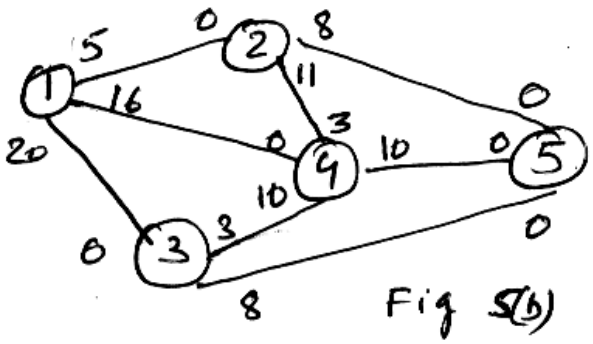

Fig 5(b)

10

6. a. Explain six key properties of exponential distribution. 6

   b. A linear Markovian birth process initialized at one member experience an average hourly birth rate $\lambda = 2$ determine the probability of having a population larger than 3 of the 1 hour and expected population at that time. 6

   c. A harbor has single doc arrival rate of the ship follows Poison's distribution unloading time follows exponential distribution arrival rate is 8 ship/week and service rate is 14 ships/week. Find (i) utilization of dock (ii) Average waiting number in queue (iii) Average waiting number in system (iv) Average waiting time. 8

7. a. Explain the characteristics of Dynamic programming problem. 8

   b. Solve the linear programming problem using dynamic programming. 12

$$Z = 10x_1 + 30x_2$$

Subject to $3x_1 + 6x_2 \le 168$

$12x_2 \le 240 \quad x_1$ and $x_2 \ge 0$

8. a. Consider the pay-off matrix in table (8a). Solve it optimally using graphical method. 10

Table 8a

		Player B	
		1	2
Player A	1	1	3
	2	3	1
	3	5	-1
	4	6	-6

   b. State and prove Min Max theorem. 5

   c. Explain terms: (i) Pure and mixed strategies
   (ii) Saddle point. 5

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