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

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Industrial and Production Engineering

Semester End Examination; Dec. - 2015

Operations Research

Time: 3 hrs   Max. Marks: 100

Note: Answer any *FIVE* full questions, selecting at least *TWO* full questions from each *part*.

PART - A

1 a. List and explain characteristics of OR.   4

b. A company manufactures two products A and B. Both products A and B pass through three departments of the plant. The production rate per shift (8hrs) for each product and available hour per product and available hour per month of each department are given below.

Product	Department		
	1	2	3
	Production	Rate per	shift
A	2	$\frac{4}{3}$	4
B	$\frac{4}{3}$	2	4
Available hrs/month	1200	1800	800

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The marketing department requires that at least 200 units of product A and 250 units of product B must be made available per month. The unit contribution of the two products are ` 120 and ` 140 respectively. Formulate as LPP and solve graphically.

2 a. Write the dual form of the following primal,

$$Min\ Z = 4x_1 + x_2$$
$$3x_1 + x_2 \geq 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 3$$
$$x_1, x_2 \leq 0$$

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b. Solve by Simplex method,

$$Max\ Z = 2x_1 + x_2$$
$$\text{sub to } 4x_1 + 3x_2 \leq 12$$
$$4x_1 + x_2 \leq 8$$
$$4x_1 - x_2 \leq 8$$
$$x_1, x_2 \geq 0$$

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3 a. What are the difference between assignment and Transportation problem?   4

b. A company has three factories F_1, F_2 and F_3 with production capacities 100, 250 and 150 units per day respectively. These units are to be shipped to four warehouses W_1, W_2, W_3 and W_4 with requirements of 90, 160, 200 and 50 units per day respectively. The transportation cost (`) per unit between factories and warehouses are given. Find the minimum transportation cost. Find initial solution by North West corner method and optimal solution by MODI method.   16

		Warehouse				
		W_1	W_2	W_3	W_4	Supply
	F_1	30	25	40	20	100
Factory	F_2	29	26	35	40	250
	F_3	31	33	37	30	150
	Demand	90	160	200	50	

4 a. Explain the situation where travelling salesman problem is used.   4

b. Alpha corporation has four plants each of which manufacture any one of four products. Production cost differs from one plant to another, as do sales revenue.

	Sales Revenue(`)			
Product→	1	2	3	4
A	50	68	49	62
B	60	70	51	74
C	55	67	53	70
D	58	65	54	69

Plant

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	Production cost			
Product→	1	2	3	4
A	49	60	45	61
B	55	63	45	69
C	52	62	49	68
D	55	64	48	66

Given the sales revenue and cost data in the above table. Obtain which product each plant should produce to maximize profit.

PART - B

5 a. What are PERT assumptions?   4

b. For the following project indirect cost is ` 50/day. Find the optimal cost and optimal duration.

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Activity	Normal		Crash	
	Days	Cost (`)	Days	Cost (`)
1 – 2	3	50	2	100
1 – 4	6	140	2	260
1 – 3	2	50	1	80
2 – 4	5	100	3	180
3 – 5	2	50	2	50
2 – 5	7	120	5	180
4 – 5	4	100	2	240

6 a. Explain the customer behavior with reference to Queuing theory.   6

 b. In a railway marshalling yard, good train arrive at a rate of 30 trains per day. Assuming that inter arrival time and the service time distribution follows an exponential distribution with an average of 30 min. Calculate the following:

 i) The mean queue size.   14

 ii) The probability that queue size exceeds 10.

 iii) If the input of the train increases to an average of 33 per day, what will be the changes in (i) and (ii)?

7 a. Explain the situations which demand the replacement.   4

 b. The probability P_n of failure just before age n is given below. If the individual replacement costs Rs. 12.50 and group replacement cost Rs. 3 per item. Find the optimal replacement policy.   16

N	1	2	3	4	5
P_n	0.1	0.2	0.25	0.3	0.15

8 a. What is dominance rule?   4

 b. Explain fair game with example.   4

 c. Solve graphically :

 Find value of game   12

Player B

Player A

1	3	-3	7
2	5	4	-6

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