



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

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. - Automobile Engineering

Semester End Examination; June - 2016

Operations Research

Time: 3 hrs

Max. Marks: 100

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

ii) Assume suitable missing data if any. iii) Use of Normal distribution table is permitted.

UNIT - I

- 1 a. Discuss the main phases of operation Research. 6
- b. A firm plans to purchase at least 200 quintals of scrap containing high quantity metal X and low quality metal Y. It decides that the scrap to be purchased must contain at least 100 quintal of X-metal and not more than 35 quintal of Y-metal. The firm can purchase the scrap from the two suppliers (A and B) in unlimited quantities. The percentage of X and Y metals in terms of Weight in the scraps supplied by A and B is given below.

Metals	Supplier A	Supplier B
X	25%	75%
Y	10%	20%

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The price of A's scrap is `200 per quintal and that of B's scrap is `400 per quintal. Formulate this problem as LP model and solve it to determine the quantities that the firm should buy from the two suppliers, so as to minimize the total purchase cost.

- 2 a. Define slack, surplus and artificial variable. 6
- b. Solve the following LPP by simplex method,

$$\text{Minimize } Z = x_1 - 3x_2 + 2x_3$$

$$\text{Sub to } 3x_1 - x_2 + 3x_3 \leq 7$$

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

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

$$x_1, x_2, x_3 \geq 0$$

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UNIT - II

- 3 a. Explain how to overcome degeneracy in transportation problem. 4
- b. A manufacturer of Jeans is interested in developing an advertising campaign that will reach four different age groups. Advertising campaigns can be conducted through TV, radio and magazines. The following table gives the estimated cost in paise per exposure for each age group according to the medium employed. In addition maximum exposure levels possible in each of the media namely TV, Radio and magazines are 40, 30 and 20 millions respectively. Also the minimum derived exposures within each age group, namely 13 - 18, 19 - 25, 26 - 35, 36 and older are 30, 25, 15 and 10 millions. The objective is to minimize the cost of assigning the minimum exposure levels in each age group. 16

Contd...2

Media	Age groups			
	13 - 18	19 - 25	26 - 35	36 and older
T.V.	12	7	10	10
Radio	10	9	12	10
Magazine	14	12	9	12

(i) Formulate the above as a transportation problem and find the optimal solution.

(ii) Solve this problem if the policy is to provide at least 4 million exposures through TV, in the 13 - 18 age group and at least 8 million exposures through TV in the age group 19-25.

4 a. The owner of a small machine shop has four machines available to assign jobs for the day. Five jobs are offered with expected profit for each mechanic on each job which are as follows:

		Jobs				
		A	B	C	D	E
Mechanics	1	62	78	50	111	82
	2	71	84	61	73	59
	3	87	92	111	71	81
	4	48	64	87	77	80

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Find by using the assignment method, the assignment of mechanics to the job that will result in a maximum profit. Which jobs should be declined?

b. A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and then return to the starting point. Cost of going from one city to another is shown below. You are required to find the least cost route.

		To city				
		A	B	C	D	E
From city	A	-	4	10	14	12
	B	12	-	6	10	4
	C	16	14	-	8	14
	D	24	8	12	-	10
	E	2	6	4	16	-

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UNIT - III

5 a. We have five jobs each of which must go through the machines A, B and C in the order ABC. Determine the sequence that will minimize the total elapsed time.

Jobs No.	1	2	3	4	5
M/c A	5	7	6	9	5
M/c B	2	1	4	5	3
M/c C	3	7	5	6	7

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- b. Use the graphical method to minimize the time need to process the following jobs on the machine shown that is for each machine find the job which should be done first. Also calculate the total elapsed time to complete both the jobs.

Jobs 1	Sequence of M/c	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence of m/c	B	C	A	D	E
	Time	5	4	3	2	6

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- 6 a. How the queues are classified? Explain the customer's behaviour.
- b. In a railway Marshalling yard, goods train arrives 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 minutes. Calculate the following :

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- (i) The mean queue size (ii) The probability of queue size exceeds 10
- (iii) If the input of the train increases to an average of 33 per day.

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What will be the changes in, (i) and (ii).

UNIT - IV

- 7 a. What are the rules for constructing the network diagram?
- b. A small maintenance project consists of the following jobs whose precedence relationships is given below :

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Job	1 - 2	1 - 3	2 - 3	2 - 5	3 - 4	3 - 6	4 - 5	4 - 6	5 - 6	6 - 7
Duration(days)	15	15	3	5	8	12	1	14	3	14

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- (i) Draw an arrow diagram representing the project.
- (ii) Find the total float for each activity.
- (iii) Find the critical path and the total project duration.

- 8 a. Define optimistic time, most likely time and pessimistic time.
- b. The following table shows the jobs of a network along with their time estimates.

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Jobs	1 - 2	1 - 6	2 - 3	2 - 4	3 - 5	4 - 5	6 - 7	5 - 8	7 - 8
t ₀	1	2	2	2	7	5	5	3	8
t _m	7	5	14	5	10	5	8	3	17
t _p	13	14	26	8	19	17	29	9	32

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Draw the project network and find the probability that the project is completed in 40 days.

UNIT - V

- 9 a. In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and losses $\frac{1}{2}$ unit of value when there are one head and one tail. Determine the pay off matrix. The best strategies for each player and the value of game to A.

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- b. Two competitors A and B are competing for the same product. Their different strategies are given in the following payoff matrix

		Company B				
		I	II	III	IV	
Company A	I	3	2	4	0	10
	II	3	4	2	4	
	III	4	2	4	0	
	IV	0	4	0	8	

Use dominance principle to find the optimal strategies.

- 10 a. Explain briefly the different types of inventory. 4
- b. The annual demand of an item is 3200 units. The unit cost is `6/- and inventory carrying charges 25% per annum. If the cost of one procurement is `150/-. Determine;
- (i) EOQ 16
 - (ii) No. of orders per year
 - (iii) Time between two consecutive orders
 - (iv) The optimal cost.

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