



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

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Automobile Engineering

Semester End Examination; June - 2017

Operations Research

Time: 3 hrs

Max. Marks: 100

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

ii) Use of Normal distribution table is permitted.

UNIT - I

- 1 a. What is OR? Discuss briefly the important areas of application of OR. 8
- b. Solve the following LPP by graphical method,
- Minimize $Z = 6x_1 + 4x_2$
- Subject to $3x_1 + x_2 \geq 24$ 12
- $x_1 + x_2 \geq 16$
- $2x_1 + 6x_2 \geq 48$
- Where $x_1, x_2 \geq 0$

- 2 a. How are the following identified in simplex method: Feasible solution, unbounded solution 4
- b. Solve the following LPP by Big-M method,
- Maximize $Z = 2x_1 + 3x_2 + 4x_3$
- Subject to $3x_1 + x_2 + 4x_3 \leq 60$ 16
- $2x_1 + 4x_2 + 2x_3 \geq 48$
- $2x_1 + 3x_2 + 3x_3 = 54$
- $x_1, x_2, x_3 \geq 0$

UNIT - II

- 3 a. What is degeneracy in transportation problem? How is it resolved? 4
- b. A company has four plants at locations A, B, C and D which supply to four warehouses located at E, F, G and H. Transportation cost per unit between various plants and warehouses are as follows:

		Warehouse				Supply
		E	F	G	H	
Plants	A	48	60	56	58	140
	B	45	55	53	60	260
	C	50	65	60	62	360
	D	52	64	55	61	220
Demand		200	320	250	210	

- i) Find the optimum transportation schedule and cost
- ii) Is the solution unique? If not, find the alternate solution.

- 4 a. A floor shop is faced with a problem of assigning four operators to four machines. The assignment cost in Rs. is given below:

		Machine			
		A	B	C	D
Operator	1	5	5	--	2
	2	7	4	2	3
	3	9	3	5	--
	4	7	2	6	7

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Operator 1 cannot be assigned to machine C operator 3 cannot be assigned to machine D. Find the optimal assignment.

Suppose a fifth machine is made available. Its respective assignment costs in Rs. to four operators are 2, 1, 2 and 8. The new machine replaces an existing one, is the replacement can be justified economically. Reformulate the problem as an assignment model and find the optimal solution. Is it economical to replace one of the existing machines? If so, which one?

- b. A machine operator processes four jobs on his machine. The setup cost per change depends on the job currently on the machine and setup to be made according to the following table.

		To			
		A	B	C	D
From	A	∞	4	7	3
	B	4	∞	6	3
	C	7	6	∞	7
	D	3	3	7	∞

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If each job is to be processed once and only once each week, how should the jobs must be sequenced on the machine?

UNIT -III

- 5 a. Determine the optimal sequence that will minimize the total elapsed time based on the following information. All the jobs are to be processed on the machines in the order ABC.

		Jobs				
		1	2	3	4	5
From	A	5	7	6	9	5
	B	2	1	4	5	3
	C	3	7	5	6	7

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- b. Use graphical method to minimize the time needed to process the following jobs on the machines shown below. Calculate the total time needed to complete both the jobs.

Job1	Sequence	A	B	C	D	E
	Time(in hours)	6	8	4	12	4
Job2	Sequence	B	C	D	A	E
	Time(in hours)	10	8	4	6	12

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- 6 a. How the queues are classified? Explain the customer’s behavior. 8
- b. Vehicles arrive at a petrol pump, having one petrol unit, in Poisson fashion with an average of 10 units per hour. The service time is exponentially distributed with a mean of 3 minutes. Determine :
- i) Average number of units in the system ii) Average waiting time of customer 12
 - iii) Probability that a customer arriving at the pump will have to wait
 - iv) The utilization factor for the pump unit v) Average length of queue
 - vi) Probability that the number of customers in the system is 2.

UNIT - IV

- 7 a. Write Fulkerson’s Rule for numbering the events. 4
- b. The following table gives the list of activities and duration :

Activities	1-2	1-3	1-4	2-3	3-4	2-6	3-5
Duration (Hours)	4	5	3	3	4	2	6
Activities	5-6	6-8	5-8	4-7	5-7	7-8	
Duration (Hours)	5	7	6	4	4	8	

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- i) Draw the network
 - ii) Calculate early start, early finish, late start and late finish time for each activity
 - iii) What will be the total float and free float of each activity?
 - iv) Identify the critical path and find the minimum time of completion of the project.
- 8 a. Differentiate between PERT and CPM. 4
- b. The following table lists the jobs of a network with their time estimates.

	Duration in days		
Job	Optimistic	Most likely	Pessimistic
1 - 2	3	6	15
1 - 6	2	5	14
2 - 3	6	12	30
2 - 4	2	5	8
3 - 5	5	11	17
4 - 5	3	6	15
6 - 7	3	9	27
5 - 8	1	4	4
7 - 8	4	19	28

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- i) Draw the project network
- ii) Calculate the length and variance of the critical path
- iii) What is the probability that the jobs on critical path will be completed by 42 days?

UNIT - V

9 a. Solve the following game:

		Player B				
		1	2	3	4	5
Player A	1	-2	0	0	5	3
	2	3	2	1	2	2
	3	-4	-3	0	-2	6
	4	5	3	-4	2	6

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b. Solve the following game by using principle of dominance.

		Player B					
		1	2	3	4	5	6
Player A	1	-5	1	2	4	3	7
	2	-1	2	2	4	3	4
	3	-2	2	2	4	3	3
	4	2	1	1	4	2	0
	5	3	2	2	4	3	1

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10 a. Define the following terms as applied to inventory models :

- i) Holding cost
- ii) Reorder level
- iii) Delivery lag
- iv) Deterministic demand.

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b. A manufacturer has to supply customer 600 units of his product per year. The shortages are not allowed and storage cost amount to Rs.0.60 per unit per year, the set up cost per run is Rs.80.

- Find :
- i) The economic order quantity
 - ii) The minimum average yearly cost
 - iii) The optimum number of orders per year
 - iv) The optimum period of supply per optimum order.

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