B.E. Eighth Semester (Mechanical Engineering) (CGS)

10895 : Operations Research Techniques : 8 ME 04

P. Pages : 4 **AU - 2988**

Time : Three Hours *0846* Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Define OR What are various characteristics of OR? Explain. **6**

b) What are various phases of OR? Explain. **7**

OR

2. a) Using graphical method of LPP find maximum value of **8**

$z = 80x_1 + 120x_2$

Subject to constraints,

$x_1 + x_2 \leq 9$

$x_1 \geq 2$

$x_2 \geq 3$

$2x_1 + 50x_2 \leq 360$

b) Write dual of the following primal LP problem **5**

$z_{max} = 2x_1 + 5x_2 + 6x_3$

Subject to

i) $5x_1 + 6x_2 - x_3 \leq 3$

ii) $-2x_1 + x_2 + 4x_3 \leq 4$

iii) $x_1 - 5x_2 + 3x_3 \leq 1$

iv) $-3x_1 - 3x_2 + 7x_3 \leq 6$ and $x_1, x_2, x_3 \geq 0$

3. A company has four warehouses a, b, c and d. It is required to deliver a product from these warehouses to three customer A, B and C.

The warehouses have following amount of a stock

Warehouse :	a	b	c	d
No. of units:	15	16	12	13

and the customer's requirement are

Customer:	A	B	C
No. of units:	18	20	18

The table below shows the cost of transporting one unit from warehouse to the customer

		Warehouse			
		a	b	c	d
Customer	A	8	9	6	3
	B	6	11	5	10
	C	3	8	7	9

Find 7

a) Initial basic feasible solution to the above transportation problem using Vogel's approximation method.

b) Determine optimal solution to above problem for minimum transportation cost using MODI method. 7

OR

4. a) A captain of cricket team has to allot five middle batting positions to five batsmen. The average run scored by each batsmen at these positions are as follows. **10**

		Batting Position				
		III	IV	V	VI	VII
Batsmen	A	40	40	35	25	50
	B	42	30	16	25	27
	C	50	48	40	60	50
	D	20	19	20	18	25
	E	58	60	59	55	53

Make the assignment so that the expected total average runs scored by these batsmen are maximum.

b) Discuss the importance of transportation and assignment models in industries for decision making process considering areas of application. 4

5. a) What do you mean by PERT and CPM. Write basic difference between them. Discuss significance of using PERT & CPM. 6

b) The following table gives activities in a construction project and other relevant information: 7

Activity :	1 – 2	1 – 3	2 – 3	2 – 4	3 – 4	4 – 5
Duration :	20	25	10	12	6	10

i) Draw the network of project.

ii) Find critical path

iii) Find free, total and independent floats for each activity.

OR

6. A project has the following activities and other characteristics. **13**

Activity	Preceding Activity	Time Estimates (weeks)		
		Optimistic	Most likely	Pessimistic
A	-	4	7	16
B	-	1	5	15
C	A	6	12	30
D	A	2	5	8
E	C	5	11	17
F	D	3	6	15
G	B	3	9	27
H	E, F	1	4	7
I	G	4	19	28

a) Draw the network diagram of the project

b) Identity the critical path.

c) Prepare activity schedule for project.

d) Determine mean project completion time.

e) Find probability that the project is completed in 36 weeks.

SECTION – B

7. a) What are the major components of waiting line system? Explain. **4**

b) A car servicing station has two bays where service can be offered simultaneously. Due to space limitation only four cars are accepted for servicing. The arrival pattern is Poission with 120 cars per day. The service time in both ways is exponentially distributed with $\mu = 96$ cars / day per bay. Find the average number of cars in service station, the average number of cars waiting to be serviced and the average time a car spends in the system. **9**

OR

8. a) A book binder has one printing press, on binding machine and manuscripts of a number of books. The time required to perform the printing and binding operation of each book are shown below. The binder wishes to determine the order in which the books should be processed, so that the total time required to process all books is minimized. **9**

Book	1	2	3	4	5	6
Printing time (Hours)	30	120	50	20	90	110
Binding time (Hours)	80	100	90	60	30	10

b) Discuss role of sequencing in manufacturing processes. **4**

9. a) What is replacement? Describe some important replacement situation. **4**

b) The truck owner finds, from his past records, that the maintenance cost per year of a truck whose purchase price is Rs.8000/- are given below: **10**

Year	Maintenance Cost (Rs.)	Resale Price (Rs.)
1	1000	4000
2	1300	2000
3	1700	1200
4	2000	600
5	2900	500
6	3800	400
7	4800	400
8	6000	400

Determine what time would it be profitable to replace the truck.

OR

10. a) Write note on Monte Carlo Simulation approach. Mention various steps in monte Carlo simulation. **4**

b) A company manufactures 200 mopeds depending upon the availability of raw materials and other conditions the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is given below. **10**

Production / day	Probability
196	0.05
197	0.09
198	0.12
199	0.14
200	0.20
201	0.15
202	0.11
203	0.08
204	0.06

The finished mopeds are transported in a specially designed three – storied lorry that can accomodate only 200 mopeds.

Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 23, 50, 77, 27, 54, and 10, Simulate the mopeds waiting in the factory?

a) What will be the average number of mopeds waiting in the factory?

b) What will be number of empty spaces in the lorry?

11. A salesman located in a city A decided to travel to city B. He knew the distances of alternative routes from city A to city B. He then drew a highway network map as show in fig. 11 a given below. The city of origin A, is city 1. The destination city B is city 10. Other cities through which the salesman will have to pass through are numbered 2 to 9. The arrow representing routes between cities and distances in Kilometers are indicated on each route. The salesman's problem is to find the shortest route that covers all selected cities from A to B. **13**

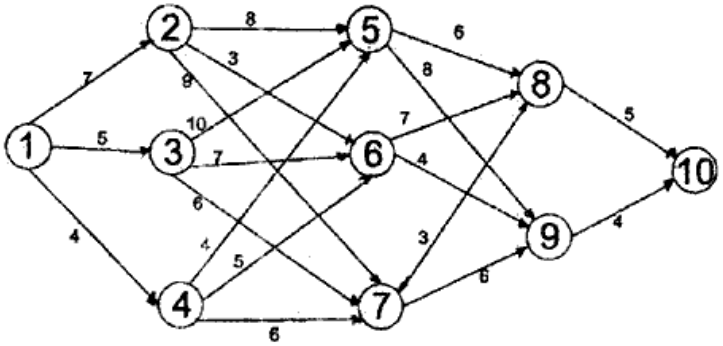

Fig-11 a

OR

12. A firm has divided its marketing area into three zones. The amount of sales depends upon the number of salesmen in each zone. The firm has been collecting the data regarding sales and salesmen in each area over number of past years. Profit (in 1000's Rs.) is summarized in the table below. Next year only 7 salesmen are available and the problem is to allocate the salesmen to three different zones so that the total sales are maximum. **13**

No. of salesmen	Zone		
	1	2	3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110

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