

**GUJARAT UNIVERSITY**  
**B.E. Sem VIII (Mech.) (New) Examination**  
**Operation Research (EP-II)**

Thursday, 19th June, 2008]

[Time : 3 Hours  
 Max. Marks : 100

- Instructions :** (1) Attempt all questions.  
 (2) Answer to the two sections must be written in separate answer books.  
 (3) Figures to the right indicate full marks.  
 (4) Assume suitable data if necessary.

**SECTION I**



- 1 (a) Explain phases of operation research.  
 (b) Solve by graphical method.

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Maximize  $z = 2x_1 + 3x_2$   
 Subject to  $x_1 + x_2 \leq 30$   
 $x_2 \geq 3$   
 $x_2 \leq 12$   
 $x_1 - x_2 \geq 0$   
 $x_1 \leq 20$   
 $x_1, x_2 \geq 0$

- 2 (a) Solve by simplex method

16

Maximize  $z = x_1 - 3x_2 + 2x_3$   
 Subject to  $3x_1 - x_2 + 2x_3 \leq 7$   
 $-2x_1 + 4x_2 \leq 12$   
 $-4x_1 + 3x_2 + 8x_3 \leq 10$   
 $x_1, x_2, x_3 \geq 0$

- (b) Solve by big M-method

Maximize  $z = 3x_1 + 2x_2$   
 Subject to  $2x_1 + x_2 \leq 1$   
 $3x_1 + 4x_2 \geq 4$   
 $x_1, x_2 \geq 0$

**OR**

- 2 (a) Use two phase simplex method to

16

Maximize  $z = x_1 + x_2$   
 Subject to  $2x_1 + x_2 \geq 4$   
 $x_1 + 7x_2 \geq 7$   
 $x_1, x_2 \geq 0$

- (b) Construct the dual of the primal problem.

Maximize  $z = 2x_1 + x_2 + x_3$   
 Subject to  $x_1 + x_2 + x_3 \geq 6$   
 $3x_1 - 2x_2 + 3x_3 = 3$   
 $-4x_1 + 3x_2 - 6x_3 = 1$   
 $x_1, x_2, x_3 \geq 0$

[P.T.O.]

196E157-2

- 3 (a) A salesman wants to visit cities A, B, C, D and E. He does not want to visit any city twice before completing his tour of all the cities and wishes to return to the point of starting journey. Cost of going from one city to another (in hundred rupees) is shown in table below. Find the least cost route. 18

	A	B	C	D	E
A	0	2	5	7	1
B	6	0	3	8	2
C	8	7	0	4	7
D	12	4	6	0	5
E	1	3	2	8	0

- (b) A department store wishes to purchase the following quantities of lady dresses :

Dress type	A	B	C	D
Quantity	150	100	75	250

Tenders are submitted by three different manufacturers who undertake to supply not more than the quantities below.

Manufacturer	W	X	Y
Total quantity	350	250	150

The store estimates that its profit per dress will vary with the manufacturer as shown in the matrix below. How should orders be placed ?

		<b>Dresser</b>			
		A	B	C	D
Manufacturers	W	2.75	3.50	4.25	2.25
	X	3.00	3.25	4.50	1.75
	Y	2.50	3.50	4.75	2.00

OR

- 3 (a) A company has a team of four salesman and there are four districts where the company wants to start its business. After taking into account the capabilities of salesman and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as below : 18

		<b>Districts</b>			
		1	2	3	4
Salesman	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesman to various districts which will yield maximum profit.

- (b) Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method and optimal solution by MODI method :

		<b>Warehouses</b>				
		W1	W2	W3	W4	Capacity
Factories	F1	10	30	50	10	7
	F2	70	30	40	60	9
	F3	40	8	70	20	18
Requirement		5	8	7	14	34

## 196E157-3

### SECTION II

- 4 (a) Discuss the factors responsible for replacement of an item or equipment. 16
- (b) The initial price of an equipment is Rs. 5,000. The running cost varies as shown below :
- |                    |     |     |     |      |      |      |      |
|--------------------|-----|-----|-----|------|------|------|------|
| Year               | 1   | 2   | 3   | 4    | 5    | 6    | 7    |
| Running cost (Rs.) | 400 | 500 | 700 | 1000 | 1300 | 1700 | 2100 |
- Taking a discount rate of 0.90, find out the optimum replacement interval.

OR

- 4 (a) A manufacturer is offered two machines A and B. A has cost price of Rs. 2500, its running cost is Rs. 400 for each of the first 5 years and increases by Rs. 100 every subsequent year. Machine B having the same capacity as A, costs Rs. 1250, has running cost of Rs. 600 for 6 years, increasing by Rs. 100 per year there after. If money is worth 10%, per year, which machine should be purchased ? Scrap value of both machines is negligibly small. 16
- (b) The following failure rates have been observed for a certain type of transistors in a digital computer.
- |                                |      |      |      |      |      |      |      |      |
|--------------------------------|------|------|------|------|------|------|------|------|
| End of the week                | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
| Probability of failure to data | 0.03 | 0.13 | 0.25 | 0.43 | 0.68 | 0.88 | 0.96 | 1.00 |

The cost of replacing an individual failed transistor is Rs. 1.25. The decision is made to replace all these transistors simultaneously at fixed intervals and to replace the individual transistor as they fail in service. If the cost of group replacement is 30 paise per transistor, what is the best interval between group replacement ? At what group replacement price per transistor would a policy of strictly individual replacement becomes preferable to the adopted policy.

- 5 (a) Explain the following terms with respect to queuing models : 16
- |                           |                   |
|---------------------------|-------------------|
| ( i ) Arrival Pattern     | ( v ) Reneging    |
| ( ii ) Service discipline | ( iv ) Jockeying  |
| ( iii ) Service mechanism | ( vii ) Collusion |
| ( iv ) Balking            | ( viii ) Queue    |
- (b) A TV repairman finds that the time spend on his job has an exponential distribution with mean 30 minutes. If the repair sers in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8 hour day, what is repairman's expected idle time each day ? How many jobs are ahead of average set just brought ?

OR

- 5 (a) Write a note on Kendall's notation for queuing models. 16
- (b) In a railway marshalling yard, goods train arrive at a rate of 30 trains per day. Assuming that the interarrival time follows an exponential distribution and service time distribution is also exponential with an average 36 minutes,
- Calculate :
- ( i ) the mean queue size (line length)
  - ( ii ) the probability that the queue size exceed 10.

### 196E157-4

- 6 ( a ) Explain the following terms with respect to game theory.
- ( i ) Two person zero sum game
  - ( ii ) Mixed strategy
  - ( iii ) Pay off
  - ( iv ) Saddle point
  - ( v ) Dominance property
- ( b ) Using dominance property find the value of game by graphical method.

B

		$y_1$	$y_2$	$y_3$	$y_4$
A	$x_1$	19	6	7	5
	$x_2$	7	3	14	6
	$x_3$	12	8	18	4
	$x_4$	8	7	13	1

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