10ME74

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Operations Research

Time: 3 hrs.
Max. Marks:100

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

PART – A

1   a. Briefly explain the scopes of Operation Research. **(05 Marks)**
    b. A farmer has 100 acre farm. He can sell all tomatoes, lettuce or radishes and can rise the price to obtain Rs 1.00 per kg for tomatoes, Rs 0.75 a head for lettuce and Rs 2.00 per kg for radishes. The average yield per acre is 2000 kgs of tomatoes, 3000 heads of lettuce and 1000 kgs of radishes. Fertilizers are available at Rs 0.50 per kg and the amount required per acre is 100 kgs each for tomatoes and lettuce and 50 kgs for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man days for tomatoes and radishes and 6 man days for lettuce. A total of 400 man days of labour are available at Rs 20 per man day. Formulate this problem as a linear programming model to maximize the farmer's total profit. **(15 Marks)**

2   a. Write the dual of the following LPP.
    Minimize $Z = 3x_1 - 6x_2 + 4x_3$
    Subject to $4x_1 + 3x_2 + 6x_3 \geq 9$
    $\qquad\qquad 1x_1 + 2x_2 + 3x_3 \geq 6$
    $\qquad\qquad 6x_1 - 2x_2 - 2x_3 \leq 10$
    $\qquad\qquad x_1 - 2x_2 + 6x_3 \geq 4$
    $\qquad\qquad 2x_1 + 5x_2 - 3x_3 \geq 6$
    $\qquad\qquad x_1 , x_2, x_3 \geq 0.$ **(05 Marks)**
   b. Solve the following Linear Programming problem.
    Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$
    Subject to $x_1 + 2x_2 + 3x_3 = 15$
    $\qquad\qquad 2x_1 + x_2 + 5x_3 = 20$
    $\qquad\qquad x_1 + 2x_2 + x_3 + x_4 = 10$
    $\qquad\qquad x_1, x_2, x_3, x_4 \geq 0.$
    Solve by using Two phase method. **(15 Marks)**

3   a. ABC Limited has three production shops supplying a product to 5 warehouses. The cost of production varies from shop to shop, cost of transportation from shop to shop cost of transportation from shop to warehouses also varies. Each shop has a specific production capacity of each warehouse has certain amount of requirement. The cost of transportation are as given below :

Shop	Warehouse					Capacity	Cost of production
	I	II	III	IV	V		
A	6	4	4	7	5	100	14
B	5	6	7	4	8	125	16
C	3	4	6	3	4	175	15
Requirement	60	80	85	105	70		

Find the optimum quantity to be supplied from each shop to different warehouse at minimum cost. **(12 Marks)**
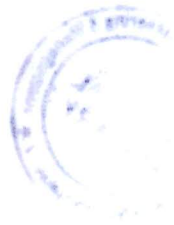
b. A ABC company has 5 tasks and 5 persons to perform. Determine the optimal assignment that minimizes the total cost. **(08 Marks)**

Jobs	Machines				
	A	B	C	D	E
P	6	7	5	9	4
Q	7	5	10	9	6
R	5	4	3	6	5
S	8	3	5	6	4
T	4	7	5	6	6

4 a. Explain the importance of integer programming. **(05 Marks)**

b. Solve the following linear programming by Gomory technique :

Maximize $Z = x_1 + x_2$

Subject to $2x_1 + x_2 \leq 6$

$$4x_1 + 5x_2 \leq 20$$

$x_1 \, x_2 \geq 0$ and integers. **(15 Marks)**

PART – B

5 a. Define the following terms with reference to PERT :

i) Total float   ii) Free float   iii) Independent float. **(06 Marks)**

b. A project schedule has the following characteristics.

Activity	Time (weeks)	Activity	Time (weeks)
1 – 2	4	5 - 6	4
1 - 3	1	5 - 7	8
2 - 4	1	6 - 8	1
3 - 4	1	7 - 8	2
3 - 5	6	8 - 10	5
4 - 9	5	9 - 10	7

i) Draw the network and find the critical path.

ii) Compute EST, EFT, LST, LFT, total float for each activity. **(14 Marks)**

6 a. Briefly explain queuing system and its characteristics. **(06 Marks)**

b. Arrival rate of telephone call at a telephone booth are according to Poisson distribution, with an average time of 9 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed with mean 3 minutes.

i) Determine the probability that a person arriving at the booth will have to wait.

ii) Find the average queue length.

iii) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least 4 minutes for the phone. Find the increase in flow rate of arrivals which will justify a second booth.

iv) What is the probability that he will have to wait for more than 10 minutes before the phone is free? **(14 Marks)**

7 a. Solve the following game by Graphical method. **(14 Marks)**

$$
\begin{array}{c c c c c c c}
 & & & & B & & \\
 & & 1 & 2 & 3 & 4 & 5 \\
A & 1 & 3 & 0 & 6 & -1 & 7 \\
  & 2 & -1 & 5 & -2 & 2 & 1 \\
\end{array}
$$

b. Use Dominance Rule to find the optimum strategies for both the player. **(06 Marks)**

$$
\begin{array}{c}
 & B_1 \ B_2 \ B_3 \ B_4 \ B_5 \ B_6 \\
\begin{array}{c} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array}
\begin{bmatrix}
4 & 2 & 0 & 2 & 1 & 1 \\
4 & 3 & 1 & 3 & 2 & 2 \\
4 & 3 & 7 & -5 & 1 & 2 \\
4 & 3 & 4 & -1 & 2 & 2 \\
4 & 3 & 3 & -2 & 2 & 2
\end{bmatrix}
\end{array}
$$

8 a. Define i) Total elapsed time   ii) Idle time.   **(04 Marks)**

b. Find the sequence that minimized the total time required in performing the job on 3 machines in the order CBA.   **(16 Marks)**

Machine

Job	A	B	C
1	8	3	8
2	7	4	3
3	6	5	7
4	9	2	2
5	10	1	5
6	9	6	1

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