USN | | | | | | | | | | **10ME74**

Seventh Semester B.E. Degree Examination, July/August 2022
Operation Research

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Define Operation Research. Explain the phased of operation research.   **(06 Marks)**

   b. A firm plans to purchase at least 200 quintals of scarp containing high quality 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 quintals of Y-metal. The firm can purchase the scrap from 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 :

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

   The price of A's scrap is Rs. 200 per quintal and that of B's is Rs. 400 per quintal. Formulate this problem as L.P model and solve it graphically to determine the quantities that firm should buy from the two suppliers so as to minimize total purchase cost.   **(14 Marks)**

2 a. Solve the following LPP using Big M method. Also, find is there any multiple optimum solutions? If there are alternate optimum solution, identify them
       Maximize $Z = 6x_1 + 4x_2$
       subjected to constraints
       $2x_1 + 3x_2 \leq 30$
       $3x_1 + 2x_2 \leq 24$
       $x_1 + x_2 \geq 3$
       $x_1 \, x_2 \geq 0$ **(10 Marks)**

   b. Solve the following problem by dual simplex method
       Minimize 'Z' $= 2x_1 + x_2$
       subjected to constraints
       $3x_1 + x_2 \geq 3$
       $4x_1 + 3x_2 \geq 6$
       $x_1 + 2x_2 \geq 3$
       $x_1 \, x_2 \geq 0$ **(10 Marks)**

3 a. A multi plant has three manufacturing plants 'A', 'B' and 'C' and two markets 'X' and 'Y'. Production costs at A, B and C in Rs. 1500, 1600 and 1700 per piece respectively. Selling prices in 'X' and 'Y' are Rs. 4,400 and Rs. 4,700 respectably. Demands in X and Y are 3500 and 3600 pieces respectively. Production capacities at A, B and C are 2000, 3000 and 4000 pieces respectively. Transformation costs are shown in the table below.

Plant	Market	
	X	Y
A	1000	1500
B	2000	3000
C	1500	2500

   Determine the optimum distribution for the plant in order to maximize the profit.   **(10 Marks)**

b. A method's engineer wants to assign four new methods to three work centers. The assignment to the new methods will increase production and they are given below. If only one method can be assigned to a work center, determine the optimal assignment.

Method\Work center	A	B	C
1	10	7	8
2	8	9	7
3	7	12	6
4	10	10	8

(10 Marks)

4 a. Explain the branch and bound method in integer programming. (06 Marks)

b. Find the optimum integer solution to the following IPP using Gomory's method.

Maximize 'Z' = $x_1 + 2x_2$

Subjected to constraints

$2x_2 \leq 7$

$x_1 + x_2 \leq 7$

$2x_1 \leq 11$

$x_1, x_2 \geq 0$ and are integers. (14 Marks)

PART – B

5 a. Define the following :
   i) Optimistic time
   ii) Pessimistic time
   iii) Most likely time (06 Marks)

b. Activity ABC .... H and I constitute a project with the following relationship

W < X, Y means X and Y connot start until 'W' is completed.

X, Y < W means W cannot start until both X and Y are completed.

With this notation, construct the network diagram for the project having following constraints. Also, find EST, EFT, LST, LFT and total slack for each activity.

The precedence relationship are

A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I and the duration are

Activity	A	B	C	D	E	F	G	H	I
Duration	8	10	8	10	16	17	18	14	9

(14 Marks)

6 a. What are the characteristics of waiting lines? (05 Marks)

b. Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and next. The length of a phone call assumed to be distributed exponentially with mean 3 minutes. Then,
   i)   What is the probability that a person arriving at booth will have to wait?
   ii) What is the average length of the queue that form from time to time
   iii) The telephone department will install a second booth when convinced that an a arrival would expect to have to wait at least three minutes for the phone. By now much must the flow of arrivals be increased in order to justify second booth? (15 Marks)

7 a. Explain with suitable example
   i)   Pay off matrix
   ii) Game with saddle point
   iii) Game without saddle point (06 Marks)

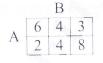b. Solve the following game graphically and find the value of Game. Also, find alternate optimal strategies, if any

$$
\begin{array}{c}
\quad\quad\quad\text{B} \\
\text{A} \quad \begin{array}{|c|c|c|}
\hline
6 & 4 & 3 \\
\hline
2 & 4 & 8 \\
\hline
\end{array}
\end{array}
$$

(07 Marks)

c. A and B play a game in which each has three coins, a 5 paise, 10 paise, and a 20 paise. Each select a coin without the knowledge of others choice. If the sum of the coins is an odd amount A win's B's coin. If the sum is even, B wins A's coin. Find the best strategy for each player and the value of game.

(07 Marks)

8 a. List the assumption made while dealing with the sequencing problem. **(04 Marks)**

b. A manufacturing company processes 6 different Jobs on two different machines A and B. Number of units of each Job and its processing time on A and B are given below table. Find the optimal sequence, Total minimum elapsed time and Idle time for either machine.

Job No	Processing time	
	Machine A	Machine B
1	5	8
2	16	7
3	6	11
4	3	5
5	9	7.5
6	6	14

(08 Marks)

c. Use graphical method to minimize the time received to process the following Jobs on the machines. Calculate the total elapsed time to complete the Jobs. For each machine specify the job that should be done first.

Job 1	sequence	A	B	C	D	E
	Time	1	2	3	5	1
Job 2	Sequence	C	A	D	E	B
	Time	3	4	2	1	5

(08 Marks)

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