SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Com. A&F - END SEMESTER EXAMINATIONS APRIL - 2024
SEMESTER - II
23UAFAT2002 - Operations Research

Total Duration : 2 Hrs. 30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Describe Limitation of operation research.
2. Solve the game whose payoff matrix is given by:

Players B Strategy

Players A Strategy	B_1	B_2	B_3	B_4
A_1	16	−60	56	−58
A_2	−20	28	−18	−24
A_3	24	8	0	24

3. Prepare the list of main advantages of simulation.
4. A small maintenance project consists of the following twelve jobs whose precedence relations are identified with their node numbers:

job(i,j)	**Duration (in days)**
(1,2)	10
(1,3)	4
(1,4)	6
(2,3)	5
(2,5)	12
(2,6)	9
(3,7)	12
(4,5)	15
(5,6)	6
(6,7)	5
(6,8)	4
(7,8)	7

Draw an arrow diagram representing the project. Calculate the earliest start, earliest finish for all jobs.

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5. A firm manufactures two products A and B on which the profits earned per unit are Rs.3 and Rs.4 respectively. Each product is processed on two machines M_1 and M_2. Product A requires one minute of processing time on M_1 and two minutes on M_2 while B requires one minute on M_1 and one minute on M_2. Machine M_1 is available for not more than 7 hours and 30 minutes, while machine M_2 is available for 10 hours during any working day. Find the number of units of products A and B to be manufactured to get maximum profit.
6. For the following game, Compute optimal strategies of A and B and value of Game using principle of dominance:

Strategies	$\mathbf{B}_1$	$\mathbf{B}_2$	$\mathbf{B}_3$	$\mathbf{B}_4$
$\mathbf{A}_1$	7	6	8	9
$\mathbf{A}_2$	-4	-3	9	10
$\mathbf{A}_3$	3	0	4	2
$\mathbf{A}_4$	10	5	-2	0

7. A bakery keeps stock of a popular brand of cake. Previous experience shows that the daily demand pattern for the item, as given below:

Daily demand	0	10	20	30	40	50
Probability	.01	.20	.15	.50	.12	.02

   Use the following sequence of random numbers to simulate the demand for next 10 days. Consider the following sequence of random numbers:
   48,78,19,51,56,77,15,14,68,09. Also estimate the daily average demand for the cakes on the basis of simulated data.

8. Distinguish between PERT and CPM.

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. Solve the following LP problem using simplex method
   Maximize Z= $x_1+4x_2+5x_3$
   Subject to the constraints
   $3x_1+3x_3 \leq 22$
   $x_1+ 2x_2+ 3x_3 \leq 14$
   $3x_1+2x_2 \leq 14$; $x_1,x_2,x_3 \geq 0$
10. A company is producing a single product and is selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in other five cities not having any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to despatch the product to needy cities in such a way that the travelling distance is minimized.

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The distances (in kms) between the surplus and deficit cities are given in the following distance matrix:

Surplus Cities \ Deficit Cities	I	II	III	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

Compute the optimal assignment schedule.

11. Determine the optimal strategies for both players and value for two-person zero-sum game whose payoff matrix is as follows:

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array} \begin{array}{c} \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{bmatrix} -6 & 7 \\ 4 & -5 \\ -1 & -2 \\ -2 & 5 \\ 7 & -6 \end{bmatrix} \end{array}$$

12. The automobile company manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions:

Production (per day)	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters. Using following random numbers:
80,81,76,75,64,43,18,26,10,12,65,68,69,61,57. Simulate the process to find out:

i) What will be the average number of scooters waiting in the factory?
ii) What will be the average of empty space on the lorry?

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13. Using the given information

Activity	**Most optimistic time (in days) a**	**Most likely time (in days) m**	**Most pessimistic time (in days) b**
1-2	4	8	12
2-3	1	4	7
2-4	8	12	16
3-5	3	5	7
4-5	0	0	0
4-6	3	6	9
5-7	3	6	9
5-8	4	6	8
7-9	4	8	12
8-9	2	5	8
9-10	4	10	16
6-10	4	6	8

Evaluate the following

(i) Expected task times and their variance.

(ii) The earliest and latest expected times to reach each event.

(iii) The critical path.

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