CBCS SCHEME

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18AE744

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

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of normal distribution chart is permitted.

Module-1

1 a. List and explain different phases of operations research. **(06 Marks)**

b. Solve the following LP problem graphically:

Minimize $Z = 2x_1 + 1.5x_2$

Subject to $x_1 + x_2 = 50$

$0.15x_1 - 0.05x_2 \geq 0$

$0.02x_1 - 0.03x_2 \geq 0$

$-0.05x_1 + 0.15x_2 \geq 0$

$x_1, x_2 \geq 0$ **(14 Marks)**

OR

2 Solve the following LPP by Big-M method :

Minimum $Z = 2x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$ **(20 Marks)**

Module-2

3 A company has four warehouses and six stores the warehouses altogether have an surplus of 22 units of a given commodity divided among them as follows:

Warehouses	1	2	3	4
Surplus	5	6	2	9

The six stores altogether need 22 units of the commodity, individual requirements at stores 1, 2, 3, 4, 5 and 6 are 4, 4, 6, 2, 4 and 2 units respectively. The cost of shipping one unit of commodity from wearhouse 'i' to store 'j' in rupees is given in the matrix below.

	Stores					
Warehouse	1	2	3	4	5	6
1	9	12	9	6	9	10
2	7	3	7	7	5	5
3	6	5	9	11	3	11
4	6	8	11	2	2	10

How should the product be shipped from the warehouses to the stores so that the transportation cost is minimum. Explain degeneracy in transportation technique in the contest of this problem. How is degeneracy resolved? **(20 Marks)**

OR

4 Solve the travelling salesman for the following data:
$C_{12} = 20$, $C_{13} = 4$, $C_{14} = 10$, $C_{35} = 6$, $C_{23} = 5$, $C_{25} = 10$, $C_{34} = 6$, $C_{54} = 20$ where $C_{ij} = C_{ji}$ and there is no route between cities i and j the values for C_{ij} is not given. **(20 Marks)**

Module-3

5 Solve the following integer programming problem by Gomory cutting plane method:
Maximum $Z = 3x_1 + 4x_2$
Subject to $2x_1 + x_2 \leq 6$
$2x_1 + 3x_2 \leq 9$
$x_1, x_2 \geq 0$ and integers. **(20 Marks)**

OR

6 A project consist of the activities for the PERT network as given in the table below:

Activity	1-2	1-3	1-4	2-3	2-5	3-4	3-6	4-6	5-6
a (days)	2	6	6	2	11	15	3	9	4
m (days)	4	6	12	5	14	24	6	15	10
b (days)	6	6	24	8	28	45	9	27	16

i) Draw the network, estimate the earliest and latest event times for all nodes and hence derive critical path.
ii) Estimate the expected duration of the project and the corresponding variance.
iii) What is the probability that the project duration will exceed 60 days. **(20 Marks)**

Module-4

7 a. Define queuing theory. Briefly explain the characteristics of queuing. **(06 Marks)**
b. A barber runs a one – man shop. Customers arrive an FCFS basis follows a poisson pattern with a mean arrival rate of 30/hour. The barber's service time appears to be exponentially distributed with a mean of 1.5 minutes. Determine:
i) The expected number of customers in the shop.
ii) The expected number of customers waiting for service.
iii) The average time a customer should expect to wait for service.
iv) The probability that the service is idle. **(14 Marks)**

OR

8 a. Briefly explain the following terms with reference to game theory:
i) Pure strategies
ii) Mixed strategies
iii) Pay off matrix
iv) Saddle point
v) Fairgame. **(10 Marks)**
b. Two players A and B playing matching coins game in which each player has 4 coins a1Rs, a2Rs, a5Rs and a10Rs, each player selects a coin without the knowledge of other choice. If the sum of the coins amount is an odd, Player-A wins player – B's coins. If the sum the coins amount is even, B wins A's coin formulate this problem as game theory problem find the optional strategies for each player and game value. **(10 Marks)**

Module-5

9 Find the sequence that minimizes the total elapsed time required to complete the following tasks:

Task	A	B	C	D	E	F	G
Time on Machine-1 (Hrs)	3	8	7	4	9	8	7
Time on Machine-2 (Hrs)	4	3	2	5	1	4	3
Time on Machine-3 (Hrs)	6	7	5	11	5	6	12

Also find the percentage of utilization and idle time of each machine. **(20 Marks)**

OR

10 a. Briefly explain the Johnson algorithm for finding the sequence for 'n' jobs through 2 machines. **(08 Marks)**

b. Find the sequence that minimizes the total elapsed time and also find total elapsed time. We have four jobs A, B, C, D each of must go through machines m_1, m_2, m_3, m_4, m_5 and m_6. The processing time in hours is given below.

	M_1	M_2	M_3	M_4	M_5	M_6
Job A	18	8	7	2	10	25
Job B	17	6	9	6	8	19
Job C	11	5	8	5	7	15
Job D	20	4	3	4	8	12

(12 Marks)

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