CBCS SCHEME

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Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
Operations Research

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Define Operations Research and explain its methodology.   **(06 Marks)**

    b.   A company is planning to determine its product mix out three different products: P_1, P_2, P_3. The monthly sale of the product P_1 is limited to a maximum of 500 units. For every two units of P_2 produced, there will be one unit of by product which can be sold at the rate of Rs.20/unit. The highest monthly demand for this by product is 200 units. The contributions/unit of the product P_1, P_2, P_3 are Rs.50, Rs.70 and Rs.60 respectively. The processing requirement for three products are shown in table below:

Process	Hours/unit			Available hours
	P_1	P_2	P_3	
I	3	5	2	1000
II	4	-	3	700
III	4	3	3	1300

       Formulate a linear programming model of this problem to find the optimum product mix such that the total contribution is maximized.   **(10 Marks)**

OR

2   a.   A plant makes 2 types of automobile parts ie, part A and part B. It buys castings that are machined, bored and polished. The data is given in the following table:

Capacity	Part A	Part B
Machining	25/hr	40/hr
Boring	28/hr	35/hr
Polishing	35/hr	25/hr

       Casting for part A Rs.20 each and for part B cost Rs.30/item. They are sold for Rs.50 and Rs.60 respectively. The running costs of the machine are Rs.200, Rs.150 and Rs.175/hr. Assuming that any combination of part A and part B can be sold, formulate as LPP.   **(08 Marks)**

    b.   Solve the following LPP graphically:

       Maximize $Z = -x_1 + 2x_2$

       Subject to constraints $-x_1 + 3x_2 \leq 10$

$$3x_1 + 8x_2 \leq 24$$
$$10x_1 + 7x_2 \leq 35$$
$$x_1, x_2 \geq 0$$

                                            (08 Marks)

Module-2

3   a.   Solve the given problem by simplex method.

       Maximize $Z = x_1 + x_2$

       Subject to constraints $2x_1 + 5x_2 \leq 18$

$$6x_1 + 5x_2 \leq 30$$
$$x_1, x_2 \geq 0$$

                                            (08 Marks)

b. Solve the given LPP by Big M method.

Maximize $Z = 3x_1 - x_2$

Subject to constraints $2x_1 + x_2 \geq 2$; $\quad x_1 + 3x_2 \leq 3$

$8x_2 \leq 4$; $\quad x_1, x_2 \geq 0$ (08 Marks)

OR

4 a. Solve the following LPP:

Maximize $Z = x_1 + 2x_2 + 3x_3$

Subject to constraints $x_1 + 2x_2 + 3x_3 \leq 10$; $\quad x_1 + x_2 \leq 5$

$x_1 \leq 1$; $\quad x_1, x_2, x_3 \geq 0$

Does this problem have an alternative optimal solution? If yes, find atleast 2 alternative optimal solutions. (08 Marks)

b. Solve the following LPP by dual simplex method:

Minimize $Z = 2x_1 + 2x_2 + 4x_3$

Subject to constraints $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 \leq 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$ (08 Marks)

Module-3

5 a. There are 3 parties who supply the following quantity of coal $P_1 = 14$ tonne, $P_2 = 12$ tonne, $P_3 = 5$ tonne. There are 3 consumers who require the coal as follows $C_1 = 6$ tonne, $C_2 = 10$ tonne, $C_3 = 15$ tonne. The cost matrix in Rs./tonne is as follows. Find the schedule of transportation policy which minimizes the cost. (08 Marks)

Party/consumers	C_1	C_2	C_3
P_1	6	8	4
P_2	4	9	3
P_3	1	2	6

b. A company has for factories A, B, C, D which supply to warehouses at E, F, G , H and I monthly capacities are 200, 225, 175 and 350 units respectively. Monthly warehouse requirements are 130, 110, 140, 260 and 180 units respectively. The shipping cost/unit in Rs. is as follows:

	E	F	G	H	I
A	14	19	32	9	21
B	15	10	18	7	11
C	26	12	13	18	16
D	11	22	14	14	18

Determine the optimum distribution for this company to minimize the shipping cost. (08 Marks)

OR

6 a. Using the following cost matrix, determine:

(i) Optimal job assignment and (ii) the cost of assignments. (08 Marks)

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

b. A machine operator processes 5 types of items on his machine each week, and must choose a sequence for them. The set-up cost per change depends on the item presently on the machine and setup to be made according to the following table:

To item

	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

If the processes each type of item once and only once each week, how should be sequence the items on his machine in order to minimize the total set-up cost? (08 Marks)

Module-4

7 a. A project consists of the following activities with their duration in days and the precedence relationship.

Activity	Precedence	Duration (in days)
A	-	5
B	-	5
C	A	4
D	B	8
E	C, D	6
F	B	5
G	E, F	7
H	E, F	7
I	E, F	4
J	G	2
K	H	5
L	I	5
M	K, L	4

(i)   Draw the network for the above project.
(ii) Identify the critical path and duration of the project.
(iii) Calculate EST, EFT, LST, LFT, TF, FF and IF for activity. (12 Marks)

b. Write difference between PERT and CPM. (04 Marks)

OR

8 a. Write a note on customer's behaviour in queueing. (04 Marks)

b. Consider a box office ticket window being manned by a single server. Customers arrive to purchase tickets according to Poisson input process with a mean rate of 30/hr. The time required to serve a customer has an exponential distribution with a mean of 90 seconds, determine:
(i)   Mean queue length
(ii) Mean waiting time in the system
(iii) The probability of a customer waiting in the queue for more than 10 min
(iv) The fraction of the time for which the server is busy. (12 Marks)

Module-5

9 a. Define the following:
(i)   Zero and non zero sum games
(ii) Strategy
(iii) Pure strategy
(iv) Mixed strategy (04 Marks)

b. Two players A and B play a game in which each has 20P, 25P and 50P coins. Each of them selects a coin without the knowledge of the other player: If the sum of the value of coins is an even number. A coins B's coin and if the sum is odd number B wins A's coin.
  (i) Develop a payoff matrix with respect to player A.
  (ii) Find the optimal strategies for player and value of the game.   **(12 Marks)**

OR

10 a. Find the sequence that minimizes the total time required in performing the job on 3 machines in the order CBA.

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

Also determine the idle time of each machine.   **(08 Marks)**

b. Two job are to be processed on 5 machines A, B, C, D and E the technological order for their jobs on the machine and the processing time of each job on each machine in as follows:

Job 1:	A – 2, B – 3, C – 4, D – 6, E – 2 = 17
Job 2:	C – 4, A – 5, D – 3, E – 2, B – 6 = 20

Determine the minimum elapsed time to complete both the jobs. Also determine the optimal sequence of jobs on each machine.   **(08 Marks)**

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