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**FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2021 ONLY)**   REG.NO

NGM COLLEGE (AUTONOMOUS) POLLACHI

END-OF-SEMESTER EXAMINATIONS: DECEMBER-2022

B. Sc-Computer Science (Aided & SF)   **MAXIMUM MARKS: 70**

III SEMESTER   **TIME: 3 HOURS**

PART III

COMPUTER BASED OPTIMIZATION TECHNIQUES

SECTION – A   **(10 X1 = 10 MARKS)**

**ANSWER THE FOLLOWING QUESTIONS
MULTIPLE CHOICE QUESTIONS**   **(K1)**

1. Linear Programming Problem (LPP) must have an_____
   a) Objective (goal) that we aim to maximize or minimize
   b) Constraints (restrictions) that we need to specify
   c) Decision variables (activities) that we need to determine
   d) all the above

2. The solution to a transportation problem with m-sources and n-destinations is feasible, if the number of allocations are_____
   a) m + n – 1   b) m + n + 1   c) m + n   d) m x n

3. The objective of network analysis is to_____
   a) minimize total project cost   b) minimize total project duration
   c) minimize production delays, interruption and conflicts   d) all the above

4. When time value of money is considered,_____
   a) costs need to be discounted
   b) timing of incurrence of costs is important
   c) the present value factors serve as the weights
   d) all of the above

5. A sequencing problem involving six jobs and three machines requires evaluation of :_____
   a) $(6! + 6! + 6!)$ sequences   b) $(6!)^3$ sequences
   c) $(6 \times 6 \times 6)$ sequences   d) $(6 + 6 + 6)$ sequences

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES   **(K2)**
6. Explain Artificial Variables.

7. Define Assignment problem.

8. Define Critical Path.

9. Explain Zero- Sum games.

10. Which costs can vary with order quantity?   **(CONTD …. 2)**

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SECTION – B   **(5 X 4 = 20 MARKS)**
ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.   **(K3)**

11.   a) Consider the following problem faced by a production planner in a soft drink plant. He has two bottling machines A and B. A is designed for 8 – ounce bottles and B for 16 – ounce bottles. However, each can be used on both types with some loss of efficiency. The following data is available:

Machine	8 – ounce bottles	16 – ounce bottles
A	100 / minute	40 / minute
B	60 / minute	75 / minute

Each machine can be run 8 hours per day, 5days per week. Profit on a 8 -ounce bottle is 25 paise and on a 16- ounce bottle is 35 paise. Weekly production of the drink cannot exceed 3,00,000 ounces and the market can absorb 25,000 8-ounce bottles and 7,000 16-ounce bottles per week. The planner wishes to maximize his profit subject, of course, to all production and marketing restrictions. Formulate this as a linear programming program.

(OR)

b) Let us assume that you have inherited Rs. 1,00,000 from your father - in - law that can be invested in a combination of only two stock portfolios, with the maximum investment allowed in either portfolio set at Rs. 75,000. The first portfolio has an average rate of return of 10%, whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on a scale from 0 to 10), and the second has 9. Since you wish to maximize your return, you will not accept an average rate of return below12% or a risk factor above 6. How much should you invest in each portfolio?
   Formulate this as a Linear Programming Problem and solve it by Graphic Method.

12.   a) Use Vogel's Approximation Method to obtain an initial basic feasible solution of the transportation problem :

$$\begin{array}{c} \quad\; D \;\; E \;\; F \;\; G \quad \text{Available} \\ \begin{array}{c} A \\ B \\ C \end{array} \begin{bmatrix} 11 & 13 & 17 & 14 \\ 16 & 18 & 14 & 10 \\ 21 & 24 & 13 & 10 \end{bmatrix} \begin{array}{c} 250 \\ 300 \\ 400 \end{array} \end{array}$$

Demand 200 225 275 250

(OR)

b) A departmental head has four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task, is given in the matrix below :

Tasks	Men			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated, one to a man, so as to minimize the total man – hours?

(CONTD …. 3)

13. a) Draw a network diagram for the following data:

Activity	:	A	B	C	D	E	F	G	H	I	J
Preceding activities :	None		A	A	B	A	B, E	C	D, F	G	H, I

(OR)

b) Explain Total float.

14. a) A firm is considering replacement of a machine , whose cost price is Rs. 12,200 and the scrap value Rs. 200. The running (maintenance and operating) cost in rupees are found from experience to be as follows:

Year	:	1	2	3	4	5	6	7	8
Running cost :		200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced?

(OR)

b) Determine the range of value p and q that will be make the payoff element a_{22}, a saddle point for the game whose payoff matrix (a_{ij}) is given below:

Player B

Player A $\begin{bmatrix} 2 & 4 & 7 \\ 10 & 7 & q \\ 4 & p & 8 \end{bmatrix}$

15. a) In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T. What is the value of T?

Job	J_1	J_2	J_3	J_4	J_5	J_6
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

(OR)

b) Neon lights in an industrial park are replaced at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs Rs. 100 to initiate a purchase order. A neon light kept in storage is estimated to cost about Rs. 0.02 per day. The lead time between placing and receiving an order is 12 days. Determine the optimum inventory policy for ordering the neon lights.

SECTION - C (4 X 10 = 40 MARKS)
ANSWER ANY FOUR OUT OF SIX QUESTIONS
(16ᵗʰ QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS
(K4 (Or) K5)

16. a) Use simplex method to

Minimize $z = x_2 + 3x_3 + 2x_5$ subject to the constraints:

$3x_2 - x_3 + 2x_5 \leq 7, \quad -2x_2 + 4x_3 \leq 12,$

$-4x_2 + 3x_3 + 8x_5 \leq 10 \; ; \; x_2 \geq 0, x_3 \geq 0, x_5 \geq 0$

17. a) Find the starting solution in the following transportation problem by Vogel's Approximation Method. Also obtain the optimum solution:

	D_1	D_2	D_3	D_4	Supply
S_1	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	

18. A project consists of a series of tasks labelled A, B, …, H, I with the following relationships (W < X, Y means X and Y cannot 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 having the following constraints:
A < D, E ; B, D < F ; C < G ; B, G < H ; F, G < I
Find also the minimum time of completion of the project, when the time (in days) of completion of each task is as follows:

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

19. Let the value of money be assumed to be 10% per year and suppose that machine A is replaced after every 3 years whereas machine B is replaced after every six years. The yearly costs of both the machines are given below:

Year	1	2	3	4	5	6
Machine A	1,000	200	400	1,000	200	400
Machine B	1,700	100	200	300	400	500

Determine which machine should be purchased.

20. The demand for an item in a company is 18,000 units per year, and the company can produce the items at a rate of 3,000 per month. The cost of one set up is Rs. 500 and the holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per month. Determine
(i) Optimum production batch quantity and the number of strategies,
(ii) Optimum cycle time and production time
(iii) Maximum inventory level in the cycle, and
(iv) Total associated cost per year if the cost of the item is Rs. 20 per unit.

21. Find the optimum order quantity for a product for which the price breaks are as follows:

Quantity	Unit cost (Rs.)
$0 \leq Q_1 \leq 800$	Re. 1.00
$800 \leq Q_2$	Re. 0.98

The yearly demand for the product is 1,600 units per year, cost of placing an order is Rs. 5, the cost of storage is 10% per year.

A-11 *********************

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