20CAP13

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MCA DEGREE EXAMINATION MAY 2022
(Second Semester)

Branch – **COMPUTER APPLICATIONS**

MATHEMATICAL OPTIMIZATION

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 The graphical method of LPP uses
(i) Objective function equation (ii) Constraint equations
(iii) Linear equations (iv) All of the above

2 To formulate a problem for solution by the simplex method, we must add artificial variable to
(i) only equality constraints (ii) only 'greater than' constraints
(iii) both (i) and (ii) (iv) None of the above

3 The solution to a transportation problem 4 rows (supplies) and 3 – columns (destination) is feasible if number of positive allocations are
(i) 7 (ii) 12
(iii) 6 (iv) 8

4 The objective of network analysis is to
(i) Minimize total project duration
(ii) Minimize total project cost
(iii) Minimize production delays, interruption and conflicts
(iv) All of the above

5 What happens when maximin and minimax values of the game are same?
(i) No solution exists (ii) Solution is mixed
(iii) Saddle point exist (iv) None of the above

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Solve by Graphical method.

Maximize $z = 5x_1 + 4x_2$

Subject to $6x_1 + 4x_2 \le 24$

$x_1 + 2x_2 \le 6$

$-x_1 + x_2 \le 1$

$x_2 \le 2$

$x_1, x_2 \ge 0$

OR

b Use graphical method to solve the following LPP.

Maximize $z = 3x_1 + 4x_2$

Subject to the constraints

$x_1 - x_2 = -1$

$-x_1 + x_2 \le 0$

$x_1, x_2 \ge 0$

Cont...

7 a Explain briefly about penality method (M-Method) for solving LPP.

OR

b Solve the following LPP by using penality method.

Minimize $z = 4x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

$x_1, x_2 \geq 0$

8 a Explain the method for finding initial solution by North-West corner method.

OR

b Describe the difference between transportation problem and assignment problem.

9 a Write the rules for constructing a network model.

OR

b Distinguish between CPM and PERT.

10 a Write short notes on Decision Making under certainty.

OR

b For the game with payoff matrix

	Player B		
Player A	B_1	B_2	B_3
A_1	-1	2	-2
A_2	6	4	-6

Determine the best strategies for players A and B. Also determine the value of game.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a A furniture manufacturer makes two products chairs and tables. Processing of these products is done on two machines A and B. A Chair requires 2 hours on machine A and 6 hours on machine B. A table requires 5 hours on machine A and no time o machine B. There are 16 hours per day available on machine A and 30 hours on machine B. profit gained by the manufacturer from a chair and a table is Rs 2 and Rs 10 respectively. What should be the daily production of each of the two products?

OR

b A company produces two types of leather belts say A and B. Belt A is of superior quality and B is inferior. Profit on the two are 40 and 30 Rupees per belt respectively. Each belt of type A requires twice as much time as required by a belt of type B. If all the belts were of type B, the company could produce 1000 belts per day.

But the supply of leather is sufficient only for 800 belts per day. Belt A requires a fancy buckle and only 400 of them are available per day. For belt B only 700 buckles are available per day. How should the company manufacture the two types of belts in order to have a maximum overall profit?

12 a Use the penality (M-method) to Solve the following LPP.

Maximize $z = 5x_1 + 3x_2$

Subject to the constraints

$$2x_1 + 4x_2 \leq 12$$
$$2x_1 + 2x_2 = 10$$
$$5x_1 + 2x_2 \geq 10$$
$$x_1, x_2 \geq 0$$

OR

b Solve the following LPP by using two phase Simplex method.

Minimize $z = x_1 - 2x_2 - 3x_3$

Subject to the constraints.

$$-2x_1 + 3x_2 + 3x_3 = 2$$
$$2x_1 + 3x_2 + 4x_3 = 1$$
$$x_1, x_2, x_3 \geq 0$$

13 a A Company has factories at F_1 F_2 and F_3 which supply to warehouses at W_1, W_2 and W_3. Weekly factory capacities are 200, 160 and 90 units respectively. Weekly warehouse requirement are 180, 120 and 150 respectively.

Unit shipping costs (in rupees) are follows.

		Ware house			
		W_1	W_2	W_3	Supply
Factory	F_1	16	20	12	200
	F_2	14	8	18	160
	F_3	26	24	16	90
	Demand	180	120	150	450

Determine the optimal distribution for this company minimize total shipping cost.

OR

b A department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix

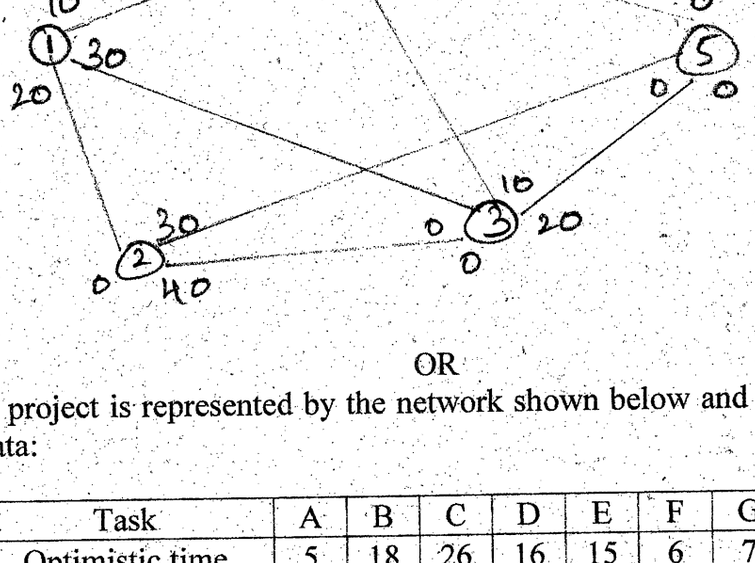
	Employees				
	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

Jobs

How should the jobs be allocated, one per employee, so as to minimize the total man-hours?

Cont...

14 a Determine the maximal flow in the network given below.



OR

b A project is represented by the network shown below and has the following data:

Task	A	B	C	D	E	F	G	H	I
Optimistic time	5	18	26	16	15	6	7	7	3
Pessimistic time	10	22	40	20	25	12	12	9	5
Most likely time	8	20	33	18	20	9	10	8	4

Determine (i) the critical path (ii) The duration of the project that will have. 95% chance of being completed.

15 a A retailer purchases cherries every morning at Rs 50 a case and sells them for Rs 80 a case. Any case remaining unsold at the end of the day can be disposed of next day at a salvage value of Rs 20 per case. Past sales have ranged from 15 tot18 cases per day.
The following is the record of sales for the past 120 days:

Cases Sold:	15	16	17	18
Number of days:	12	24	48	36

Find how many cases the retailer should purchase per day to maximize his profit.

OR

b Solve the game whose payoff matrix is given below:

	Player B			
Player A	B_1	B_2	B_3	B_3
A_1	3	2	4	0
A_2	3	4	2	4
A_3	4	2	4	0
A_4	0	4	0	8

Z-Z-Z

END