PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MCA DEGREE EXAMINATION MAY 2024
(Second Semester)

Branch - **COMPUTER APPLICATIONS**

MATHEMATICAL OPTIMIZATION

Time: Three Hours | Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

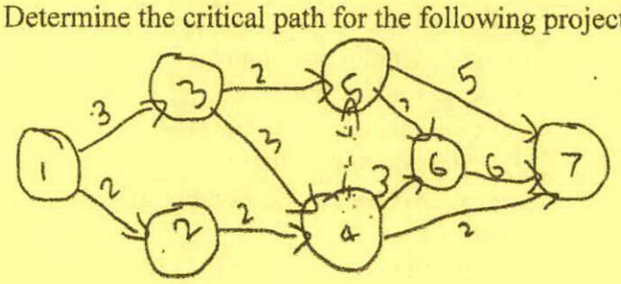
Module No.	Question No.	Question	K Level	CO
1	1	In an Linear Programming Problem functions to be maximized or minimized are called ------- a) constraints b) objective function c) basic solution d) feasible solution	K1	CO1
	2	If one or more variable vanish then a basic solution to the system is called --------- a) non feasible region b) feasible region c) degenerate solution d) basic solution	K2	CO1
2	3	Which of the following methods is used to verify the optimality of the current solution of the transportation problem------- a) Least Cost method b) Vogel's Approximation method c) Row minima method d) Modified Distribution method	K1	CO2
	4	An assignment problem is a particular case of ------. a) transportation problem b) assignment problem c) travelling salesman problem d) replacement problem	K2	CO2
3	5	A project consists of a number of tasks which are called ------ a) activities b) floats c) events d) paths	K1	CO3
	6	---------- is employed in construction and business problems. a) queue b) replacement c) CPM d) PERT	K2	CO3
4	7	A type of decision- making environment is ----- a) certainty b) uncertainty c) risk d) all of these	K1	CO4
	8	In game theory, the outcome or consequence of a strategy is referred to as the------- a) payoff b) penalty c) reward d) end-game strategy	K2	CO4
5	9	Service mechanism in a queuing system is characterized by ---------- a) customers behavior b) servers behavior c) customers in the system d) server in the system	K1	CO5
	10	The process that performs the services to the customer is known as -------- a) queue b) service channel c) customers d) server	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Construct LP model in equation form and explain with an example.	K3	CO1
		(OR)		
	11.b.	Solve the following LPP by graphical method: $Maximize\ z = 5x_1 + 4x_2$ Subject to $6x_1 + 4x_2 \leq 24$ $x_1 + 2x_2 \leq 6$ $-x_1 + x_2 \leq 1$ $x_2 \leq 2$ $x_1, x_2 \geq 0$		
2	12.a.	Develop the steps involved in Vogel's approximation method of finding the feasible solution to a transportation problem.	K3	CO2
		(OR)		
	12.b.	Solve the following assignment problem: John: Mow \$15, Paint \$10, Wash \$9 Karen: Mow \$9, Paint \$15, Wash \$10 Terri: Mow \$10, Paint \$12, Wash \$8		
3	13.a.	Write down Scope and rules of network models.	K3	CO3
		(OR)		
	13.b.	Determine the critical path for the following project network. 		
4	14.a.	Write down the Decision- making under conditions of uncertainty.	K3	CO4
		(OR)		
	14.b.	Find the ranges of values of p and q which will render the entry (2,2) a saddle point for the game. Player B Player A: A_1 (2, 4, 5); A_2 (10, 7, q); A_3 (4, P, 6)		
5	15.a.	Explain the Role of exponential distribution.	K3	CO5
		(OR)		
	15.b.	An investor invests \$1000 a month, on average, in a stock market security. Because the investor must wait for good "buy" opportunity, the actual time of purchase is random. The investor usually keeps the securities for about 3 years on the average but will sell at random times when a good "sell" opportunity presents itself. Although the investor is generally recognized as a shrewd stock market player, past experience indicates that about 25% of the securities decline at about 20% a year. The remaining 75% appreciate at the rate of about 12% a year. Estimate the investor's (long-run) average equity in the stock market.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Solve the following LPP by using Big- M method: $Minimize\ z = 4x_1 + x_2$ Subject to $3x_1 + x_2 = 3$ $4x_1 + 3x_2 \geq 6$ $x_1 + 2x_2 \leq 4$ $x_1, x_2 \geq 0$	K4	CO1
2	17	Determine the optimal solution to the following transportation problem: 1: 10, 2, 20, 11 — Supply **15** Silo 2: 12, 7, 9, 20 — Supply **25** 3: 4, 14, 16, 18 — Supply **10** Demand: **5**, **15**, **15**, **15**	K4	CO2
3	18	Tasks A, B, C, …, H, I constitute a project. The precedence relationships are $A < D; A < E; B < F; D < F; C < G; C < H; F < I; G < I$. Draw a network to represent the project and find the minimum time of completion of the project when time, in days, of each rank is as follows: Task: A B C D E F G H I Time: 8 10 8 10 16 17 18 14 9 Also identify the critical path.	K4	CO3
4	19	In a certain game, player A as three possible choices L, M, and N, while player B has two possible choices P and Q. Payments are to be made according to the choices made. Choices — Payment L, P — A pays B Rs. 3 L, Q — B pays A Rs. 3 M, P — A pays B Rs. 2 M, Q — B pays A Rs. 4 N, P — B pays A Rs. 2 N, Q — B pays A Rs. 3 What are the best strategies for players A and B in this game? What is the value of the game for A and B?	K4	CO4
5	20	Visitors parking at Ozark College is limited to 5 spaces only. Cars making use of this space arrive according to a Poisson distribution at the rate of 6 cars per hour. Parking time is exponentially distributed with a mean of 30 minutes. Visitors who cannot find an empty space on arrival may temporarily wait inside the lot until a parked car leaves. The temporary space can hold only 3 cars. Other cars that cannot park or find a temporary waiting space must go elsewhere. Determine the following: (a) The probability, p_n, of n cars in the system. (b) The effective arrival rate for cars that actually use the lot. (c) The average number of cars in the lot. (d) The average time a car waits for a parking space inside the lot. (e) The average number of occupied parking spaces. (f) The average utilization of the parking lot.	K4	CO5

Z-Z-Z END