

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U4C06

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Computer Science and Business Systems

21UCB406- INTRODUCTION TO OPERATION RESEARCH

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. Non- negative variable are also called as..... CO6- U
(a) Entering (b) Artificial (c) Leaving (d) All the above
2. The entering variable is the non-basic variable corresponding to the__ CO6- U
(a) $Z_j - C_j$ (b) $Z_j + C_j$ (c) $Z_j = C_j$ (d) $Z_j \geq C_j$
3. For solving an assignment problem which method is used CO6- U
(a) Hungarian (b) German (c) American (d) None of these
4. The term commonly used for activity slack time is CO6- U
(a) Free float (b) Independent float (c) Total float (d) All of the above
5. Minimum inventory equals CO6- U
(a) EOQ (b) Reorder level (c) Safety stock (d) reduce stock
6. Given the following data R=800 units, cost of the item=Rs.40, Inventory CO6- App
carrying cost=40%, Back order cost =Rs.10, Ordering cost =Rs.300 then Q^* is
(a) 500 units (b)456 units (c)565 units (d) 512 units
7. In M/M/C, The effective arrival rate is ____ CO6 -U
(a) λ (b) λ' (c) μ' (d) $\lambda \mu'$
8. In M/M/1, Probability that the queue size exceeds k ____ CO6 -U
(a) 0 (b) 1 (c) 2 (d) π

9. The size of payoff matrix of game can be reduced by using the principle of CO6 -U
 (a) Dominance (b) Rotation reduction (c) Game inversion (d) Game Transpose
10. Scrutiny of the following game suggests that $\begin{bmatrix} 3 & -22 \\ 0 & -45 \end{bmatrix}$ _____ is the saddle CO5 – App
 point
 (a) 22 (b) -22 (c) 11 (d) 23

PART – B (5 x 2= 10 Marks)

11. Define the terms (i) Non-degenerate basic solution (ii) Degenerate basic CO6- U
 solution
12. Give the mathematical formulation of a transportation problem.. CO6- U
13. What are the 3 types of Inventories? CO6 -U
14. Explain Kendall’s Notation (a/b/c): (d/e) of a queueing model CO6 -U
15. Identify the saddle point in the following game CO5- App

$$\begin{array}{c}
 B \\
 \begin{array}{c}
 \left[\begin{array}{ccc}
 6 & 2 & 3 \\
 2 & -1 & -3 \\
 5 & 4 & 5
 \end{array} \right] \\
 A
 \end{array}
 \end{array}$$

PART – C (5 x 16= 80Marks)

16. (a) Solve by simplex method CO1- App (16)
 Minimize $Z = 4X_1 + 3X_2$
 subject to $2X_1 + X_2 \geq 10$; $-3X_1 + 2X_2 \geq 6$; $X_1 + X_2 \geq 6$ and
 $X_1, X_2 \geq 0$
- Or
- (b) Solve the following LPP by graphical method CO1-App (16)
 Maximize $Z = 100X_1 + 40X_2$
 subject to the constraints
 $5X_1 + 2X_2 \leq 1000$
 $3X_1 + 2X_2 \leq 900$
 $X_1 + 2X_2 \leq 500$
 and $X_1, X_2 \geq 0$

17. (a) A department has five employees with five jobs to be performed. **CO2-App (16)**
 The time (in hours) each men will take to perform each job is given in the effectiveness matrix. How should the jobs be allocated, one per employee, so as to minimize the total man-hours?

		Employees				
		1	2	3	4	5
Jobs	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

Or

- (b) A project has the following time schedule **CO2-App (16)**

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

- (i) Construct the network
 (ii) Find the critical path and project Duration
 (iii) Find the total float, Free float and Independent float for each activity

18. (a) The demand for a small electronic component is at the rate of 7000units.The cost of an single component is Rs.1.25 and the inventory carrying cost is 20%.For Placing an order it costs Rs.50.Determine the following **CO3 -App (16)**

- (i) EOQ
 (ii) Total Inventory Carrying Cost
 (iii) Total Ordering Cost
 (iv) Optimum inventory cost
 (v) Optimum number of orders
 (vi) Number of days supply per optimum order

Or

- (b) Find the optimal order quantity for the product for which the price breaks are as follows **CO3- App (16)**

Quantity	Purchasing cost
$0 \leq Q_1 \leq 100$	Rs.20 per unit
$100 \leq Q_2 < 200$	Rs18 per unit
$200 \leq Q_3$	Rs.16 per unit

The monthly demand for the product is 400 units, storage cost is 20% of the unit cost and the cost of product and the cost of ordering is Rs.25 per month.

19. (a) In a super market, the average arrival rate of customer is 10 in every 30 minutes following Poisson process. The average time taken by the cashier to list and calculate the customer's purchases in 2.5 minutes, following exponential distribution. CO4-An (16)
- a) What is the probability that the queue length exceeds 6?
 b) What is the expected time spent by a customer in the system and queue?
 c) Average number of customers in the system and queue?

Or

- (b) There are three typists in an office. Each typist can type an average of 6 letters per hour. If letters arrive for being typed at the rate of 15 letters per hour. Identify the Model, what fraction of time all the typists will be busy? What is the average number of letters waiting to be typed? CO4-An (16)

20. (a) Find Solution of game theory problem using dominance method CO5-App (16)

Player A \ Player B	B1	B2	B3
A1	1	7	2
A2	6	2	7
A3	5	1	6

Or

- (b) (i) The data collected in running a machine, the cost of which is Rs. 60,000 are given below CO5-App (8)

Year	1	2	3	4	5
Resale Value	42000	3000	2040	14400	9650
Cost of Spares	4000	4270	4880	5700	6800
Cost of labors	14000	1600	1800	21000	2500

Determine the optimum period for the replacement of the machine

- (ii) The cost of a machine is Rs.6100 and its scrap value is Rs.100. CO5-App (8)
 The maintenance costs found from experience are as follows: When should the machine be replaced?

Year	1	2	3	4	5	6	7	8
Main.	100	250	400	600	900	120	160	200

