A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U4C06

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. In solving an LPP by the simplex method _____ variable is associated with equality type constraint CO6- U

   (a) Slack (b) Surplus (c) Artificial (d) Basic

2. The dual of the dual is _____ CO6- U

   (a) dual (b)Primal (c)L.P.P (d) Equal

3. Degeneracy in $m \times n$ transportation problem occurs when the number of occupied cells is _____ then _____ CO6- U

   (a) equal,m+n-1 (b) Less,m+n-1 (c) Less,m+n+1 (d) more,m+n-1

4. An assignment problem is a completely --- form of a transportation problem. CO6- U

   (a) Degenerate (b) Non degenerate (c) Feasible (d) Non feasible

5. Minimum inventory equals CO6- U

   (a) EOQ (b) Reorder level (c) Safety stock (d) reduce stock

6. An approximate percentage of A-items in a firm is around CO6- U

   (a) 5 to 10% (b) 20 to 25% (c) 70-75% (d) 10-20%

7. In M/M/C, The effective arrival rate is ___ CO6- U

   (a) λ (b) λ' (c) μ' (d) $\lambda\mu'$

8. For a model (M/M/1): (∞ /FCFS) The arrival rate is 3 per hour and service rate is 5 per hour then L_s CO4- App

(a) 3.5 (b) 2.5 (c) 4.5 (d) 1.5

9. _____ is the point of intersection of pure strategies CO6- U

(a) saddle point (b) mixed point (c)Dominance point (d) midpoint

10. Games without saddle point require players to play _____ strategies CO5- App

(a) mixed strategies (b) pure strategies (c) no strategies (d) complex strategies

PART – B (5 x 2= 10Marks)

11. When can we use the graphical method for solving a LPP? CO6- U
12. Give three reason why LPP solution techniques, is not made use for solving a transportation problems. CO6- U
13. A company uses 10,000 units per year of an item. The purchase price is one rupee per item. Ordering cost=Rs.25 per order. Carrying cost 12% of the inventory value. Find the EOQ. CO3 App
14. For a model (M/M/1): (∞ /FCFS) The arrival rate is 3 per hour and service rate is 5 per hour, Identify the queuing model, compute the value of L_s. CO4-App
15. Identify the saddle point in the following game CO5-App

$$A \begin{bmatrix} 6 & 2 & 3 \\ 2 & -1 & -3 \\ 5 & 4 & 5 \end{bmatrix} \quad B$$

PART – C (5 x 16= 80Marks)

16. (a) Find solution using Two-Phase method. CO1 App (16)

Minimize $Z = 3x_1 + 5x_2$

subject to the constraints

$2x_1 + 8x_2 \geq 40$

$3x_1 + 4x_2 \geq 50$

$X_1, x_2 \geq 0$

OR

(b) Find solution using graphical simplex method. CO1 App (16)

Maximize $Z = 15X_1 + 10X_2$

subject to the constraints

$4X_1 + 6X_2 \leq 360$

$3X_1 \leq 180$

$5X_2 \leq 200$

and $X_1, X_2 \geq 0$

17. (a) 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. CO2 App (16)

	Employees					
		I	II	III	IV	V
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

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

OR

(b) A travelling salesman, named Magan Shah plans to visit five cities 1, 2, 3, 4 and 5. The travel time (in hours) between these cities is shown below. CO2 App (16)

		To city				
		1	2	3	4	5
From city	1	x	5	8	4	5
	2	5	x	7	4	5
	3	8	7	x	8	6
	4	4	4	8	x	8
	5	5	5	6	8	x

How should he schedule his touring plan in order to minimize the total travel time, if he visits each city once a week?

18. (a) The contractor has to supply 10,000 bearings per month to an automobile manufacture. He finds that when he starts a production run he can produce 25,000 bearings per month. The cost of holding a bearing in stock for one year is Rs.180. How frequently should the production run be made? CO3 App (16)

OR

(b) The probability distribution of the demand for a certain item is as follows: CO3 App (16)

Monthly Sales	0	1	2	3	4	5	6
Probability	0.01	0.06	0.25	0.35	0.20	0.03	0.10

The cost of carrying inventory is Rs.30 per unit per month and the cost of unit short is Rs.70 per month. Determine the optimum stock level which will minimize the total expected cost.

19. (a) (i) Customers arrive at one man barber shop according to a Poisson fashion at a rate of 12 minutes, barber services customers according to an exponential distribution with mean of 10 minutes. Identify the queueing model, Calculate the following, CO4- Ana (8)

i) What is the probability that the shop is empty?

ii) What is the expected number of customers in the shop and in the queue?

iii) Find the average time a customer spends in the shop Ws

iv) Find the average number of customers in the queue Wq

(ii) Patients arrive at a clinic according to Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate of 20 per hour. Identify the queueing model, Calculate the following, CO4-Ana (8)

i) Find the effective arrival rate at the clinic.

ii) What is the probability that an arriving patient will not wait?

iii) What is the expected waiting time until a patient is discharged from
the clinic?

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 queueing model, Calculate the following, CO4-Ana (16)

(i) What fraction of time all the typists will be busy?

(ii) What is the average number of letters waiting to be typed?

(iii) Find the average waiting time of a customer in the system and in the system and in the queue?

(iv) What fraction of the idle of the office?

20. (a) Using Dominance property solve CO5- App (16)

		Player B			
		B1	B2	B3	B4
Player A	A1	3	2	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

Or

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

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

(ii) Using graphical method, solve the rectangular game payoff matrix for player A is $\begin{pmatrix} 2 & -1 & 5 & -2 & 6 \\ -2 & 4 & -3 & 1 & 0 \end{pmatrix}$ CO5- App (8)