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Question Paper Code: 46704

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth Semester

Mechanical Engineering

14UME604 - OPERATIONS RESEARCH

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

(Smith chart may be permitted)

PART A - (10 x 1 = 10 Marks)

- In simplex method, if there is tie between a decision variable and a slack (or surplus) variable, ----- should be selected
 - Slack variable
 - Surplus variable
 - Decision variable
 - None of the above
- In the simplex method, variables that are assigned zero values are called
 - Basic variables
 - Non-basic variables
 - slack variables
 - artificial variables.
- The optimality of a transportation problem is determined by the application of
 - least cost method
 - north west corner method
 - vogel's approximation method
 - modi method
- In a $n \times n$ matrix of an assignment problem, the optimality is reached when the minimum number of straight line scoring all the zero is
 - n^2
 - $1/n$
 - n
 - $n/2$

5. PERT and CPM are
 - (a) techniques to determine project status
 - (b) decision making techniques
 - (c) aids to determine the cost implications of project
 - (d) aids for decision making
6. A dummy activity is used in PERT network to represent
 - (a) Precedence relationship
 - (b) Necessary time delay
 - (c) Resource constrains
 - (d) Idle resource.
7. Expected time to complete an activity is calculated from
 - (a) Optimistic time estimate
 - (b) Most likely time estimate
 - (c) Pessimistic time estimate
 - (d) All of the above.
8. For the equipment that deteriorates in performance over time, the running cost usually
 - (a) Increases with time
 - (b) Decreases with time
 - (c) Remains constant
 - (d) Any of the above.
9. In a zero-sum game
 - (a) What one player wins, the other loses
 - (b) The sum of each player's winning if the game is played many times must be zero
 - (c) The game is fair-each player has an equal chance of winning
 - (d) Long-run profits must be zero.
10. A common assumption about the players in a game is that
 - (a) neither player knows the payoff matrix
 - (b) the players have different information about the payoff matrix
 - (c) only one of the players pursues a rational strategy
 - (d) the specific identity of the players is irrelevant to the play of the game

PART - B (5 x 2 = 10 Marks)

11. What is the role of surplus variables in the simplex method?
12. Distinguish between transportation problem and assignment problem.
13. Define event, activity, network and dummy activity.
14. Name the inventory control systems adopted in practice.

15. Classify the queuing models.

PART - C (5 x 16 = 80 Marks)

16. (a) Three grades of coal A, B and C contain phosphorous and ash as impurities. In a particular industrial process, fuel up to 100 ton (maximum) is required which should contain ash not more than 3% and phosphorous not more than 0.03%. It is desired to maximize the profit while satisfying these conditions. There is an unlimited power supply of each grade. The percentage of impurities and the profits of grades are given below (16)

Coal	Phosphorous (%)	Ash (%)	Profits in rupees per ton
A	0.02	3.0	12.00
B	0.04	2.0	15.00
C	0.03	5.0	14.00

Or

(b) Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$,

subject to $x_1 + 2x_2 + 3x_3 = 15$,

$2x_1 + x_2 + 5x_3 = 20$,

$x_1 + 2x_2 + x_3 + x_4 = 10$,

(16)

17.(a) Solve the following assignment problem:

(16)

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

Or

- (b) Consider the following transportation problem involving three sources and four destinations. The cell entries represent the cost of transportation per unit. Obtain the initial feasible solution by VAM. (16)

		Destination				Supply
		1	2	3	4	
1	3	1	7	4	300	
2	2	6	5	9	400	
3	8	3	3	2	500	
Demand	250	350	400	200	1200	

18. (a) A project schedule has the following characteristics: (16)

Activity	Time (weeks)	Activity	Times (weeks)
1 - 2	4	5 - 6	4
1 - 3	1	5 - 7	8
2 - 4	1	6 - 8	1
3 - 4	1	7 - 8	2
3 - 5	6	8 - 10	5
4 - 9	5	9 - 10	7

- (i) Construct the network.
(ii) Compute E and L for each event, and find the critical path

Or

(b) Consider the following problem involving activities from A to Z.

Activity	A	B	C	D	E	F	G	H	I	J
Immediate predecessor(s)	-	A	A	A	D	D	E	F, G	C, H	B
Duration (months)	1	4	2	2	3	3	2	1	3	2

(i) Construct the CPM network

(ii) Determine the critical path

(iii) Compute total floats and free float for non-critical activity. (16)

19. (a) (i) Explain different types of cost in inventory system and also list the models of inventory. (6)

(ii) A textile mill buys its raw material from a vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs.100 per order and the carrying cost is 20% of the purchase price per unit month, where the purchase price per unit is Rs. 1. Find the following: (i) EOQ (ii) Total cost w.r.t EOQ (iii) Number of orders per year (iv) Time between consecutive two orders. (10)

Or

(b) A look at the past records gives the following distribution for lead time and daily demand during lead time: (16)

Lead rate Distribution

Lead time (days)	0	1	2	3	4	5	6	7	8	9	10
Frequency	0	0	1	2	3	4	4	3	2	2	1

Demand rate distribution

Demand/day (units)	0	1	2	3	4	5	6	7
Frequency	3	5	4	5	2	3	2	1

20. (a) The arrival rate of customers at the single window booking counter of a two wheeler agency follows Poisson distribution and service time follows exponential distribution. Hence the service rate also follows Poisson distribution. The arrival rate and the service rate are 25 customers/hr and 35customers/hr respectively. Find the following:

- (i) Utilization of the booking clerk
- (ii) Average number of waiting customers in the queue
- (iii) Average number of waiting customers in the system
- (iv) Average waiting time per customer in the system
- (v) Average waiting time per customer in the system (16)

Or

(b) A mechanic repairs four machines. The mean time between service requirements is 5 hours for each machine and forms an exponential distribution. The mean repair time is 1 hour and also follows the same distribution pattern. Machine downtime costs Rs.20 per hour and the mechanic costs Rs. 55 per day,

- (i) Find the expected number of operating machines,
- (ii) Determine the expected downtime cost per day,
Would it be economical to engage two mechanics, each repairing only two machines? (16)

