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Question Paper Code: 46704

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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)

1. The mathematical technique for finding the best use of limited resources in an optimum manner is known as
 - (a) operations research
 - (b) linear programming
 - (c) network analysis
 - (d) Least queuing theory
2. In the simplex method, variables that are assigned zero values are called
 - (a) Basic variables
 - (b) Non-basic variables
 - (c) slack variables
 - (d) artificial variables.
3. The method used for solving assignment problem is known as
 - (a) Stepping stone method
 - (b) Modified distribution method
 - (c) Hungarian method
 - (d) Enumeration method.

4. 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
- (a) n^2 (b) $1/n$ (c) n (d) $n/2$
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. Group replacement policy is applicable for
- (a) repairable items (b) items that fail partially
 (c) items that fail completely (d) dissimilar items
9. It may not be _____ to totally avoid queue.
- (a) economical (b) bad (c) correct (d) proper
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 an 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) Consider the given linear programming model and solve it using the simplex method.

$$\text{Maximize } Z = 6X_1 + 8X_2$$

$$\text{Subject to } 5X_1 + 10X_2 \leq 60$$

$$4X_1 + 4X_2 \leq 40$$

$$X_1 \text{ and } X_2 \geq 0.$$

(16)

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) Consider the given table are involving three source and four destinations as reproduced below. The cell entries represent the cost of transportation per unit.

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

Obtain the initial basic solution using the northwest corner method and then optimize solution using U-V method. (16)

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	
Source	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) The following table gives the activities and duration of a construction project.

Activity	1-2	1-3	1-4	2-5	2-6	3-5	3-6	4-5	4-6	5-7	6-7
Duration	10	15	20	8	6	10	7	15	10	20	15

Draw the network for the project. Find the maximum flow. (16)

Or

- (b) A project schedule has the following characteristics:

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 (16)

19. (a) (i) The cost of a machine is Rs.61000 and its scrap value is Rs.1000. The maintenance cost found from past experience is as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost	1000	2500	4000	6000	9000	12000	16000	20000

When should the machine be replaced? (8)

(ii) Classify the replacement study and also show the economic life of an asset. (8)

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) Write about strain gauges on rotating shafts. (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)

