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**Question Paper Code: 46704**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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 optimality of a transportation problem is determined by the application of
  - (a) least cost method
  - (b) north west corner method
  - (c) vogel's approximation method
  - (d) modi method
4. The method used for solving assignment problem is known as
  - (a) Stepping stone method
  - (b) Modified distribution method
  - (c) Hungarian method
  - (d) Enumeration method.

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. Replacement of an existing machine aims at
  - (a) lower average annual cost of using the machine
  - (b) reduction in annual capital cost
  - (c) lesser dependence on workmen
  - (d) more automation
  
8. 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
  
9. It may not be \_\_\_\_\_ to totally avoid queue.
 

(a) economical	(b) bad	(c) correct	(d) proper
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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) 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  $Z = x_1 + 2x_2 + 3x_3 - x_4$ ,

$$\text{subject to } x_1 + 2x_2 + 3x_3 = 15,$$

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

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

(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) Solve the given assignment problem using hungerian method. The matrix entities represent the processing times in hours.

(16)

operator \ Job	1	2	3	4	5
1	10	12	15	12	8
2	7	16	14	14	11
3	13	14	7	9	9
4	12	10	11	13	10
5	8	13	15	11	15

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 an 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) 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)

Or

- (b) Consider the 4×4 game played by players A and B and solve it optimality. (16)

		Player B			
		1	2	3	4
Player A	1	6	2	4	8
	2	2	-1	1	12
	3	2	3	3	9
	4	5	2	6	10





