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**Reg. No. :**

**Question Paper Code: 46074**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Sixth Semester

Mechanical Engineering

14UME604 - OPREATIONS 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. In a n x n matrix of an assignment problem, the optimality is reached when the minimum number of straight line scoring all the zero is

(a) n2 (b) 1/n (c) n (d) n/2

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

10. When a game has a pure strategy

(a) Each player selects a particular strategy

(b) Players select their strategies arbitrarily

(c) both players select their optimal strategies

(d) none of the above

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. Write the assumptions in game theory.

PART - C (5 x 16 = 80 Marks)

16. (a) Solve the following programming problem using graphical method.

Maximize Z =100X1+80X2

Subject to

5X1+10X2≤50

8 X1+2X2≥16

3 X1-2X2≥6

X1and X2 ≥ 0. (16)

Or

(b) Maximize Z= x1 + 2x2 + 3x3 - x4,

subject to x1 + 2x2 + 3x3 = 15,

2x1 + x2 + 5x3 = 20,

X1+ 2x2 + x3 + x4 = 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  1 - 3  2 - 4  3 - 4  3 - 5  4 – 9 | 4  1  1  1  6  5 | 5 - 6  5 - 7  6 - 8  7 - 8  8 - 10  9 - 10 | 4  8  1  2  5  7 |

1. Construct the network.
2. 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 are 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 assert. (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 | | | | |
| Player A |  | 1 | 2 | 3 | 4 |
| 1 | 6 | 2 | 4 | 8 |
| 2 | 2 | -1 | 1 | 12 |
| 3 | 2 | 3 | 3 | 9 |
| 4 | 5 | 2 | 6 | 10 |