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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

**Supplementary Examination – June – 2017**

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| **Code :** | **16MA3004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED OPERATIONS RESEARCH** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course outcome | Marks |
| 1. | a. | What are the three basic elements of an Optimization Model? | CO1 | 3 |
| b. | What are the limitations of Operations Research techniques? | CO1 | 3 |
|  | c. | What are the requirements of a Linear Programming Problem? | CO1 | 4 |
|  | d. | A company manufactures two products A and B. Both the products pass through two machines M1 and M2. The time required to process each unit of products A and B on each machine and the available machine capacity are given below:   |  |  |  | | --- | --- | --- | |  | Machine | | |  | M1 | M2 | |  | Processing time per unit (in hours) | | | A | 6 | 2 | | B | 4 | 4 | | Available capacity (Hours) | 3600 | 2000 |   The availability of materials is sufficient to produce 500 nos. of product ‘A’ and 400 nos. of product ‘B’. Each unit of product ‘A’ gives a profit of Rs. 25 and each unit of product ‘B’ gives a profit of Rs. 20. Construct a Linear Programming Model to determine the quantity of each product to be manufactured to maximize the profit. | CO2 | 10 |
| (OR) | | | | |  |
| 2. | a. | Explain the following terms using graphical representation of a Linear Programmimg Model:   1. Feasible Region 2. Infeasible constraints | CO2 | 10 |
|  | b. | Solve the following Linear Programming Problem using Graphical Method.  Maximize Z = 8 X1 + 6 X2  Subject to  2 X1 + X2 ≤ 1000  X1 + X2  ≤ 800  X1 ≤ 400  X2 ≤ 700  &  X1, X2 ≥ 0 | CO3 | 10 |
|  | | | |
| 3. | a. | Define Transportation Problem. | CO1 | 3 |
|  | b. | Define the following terms in connection with Transportation Model:   1. Feasible solution 2. Basic feasible solution 3. Optimal solution | CO2 | 7 |
|  | c. | Obtain the initial basic feasible solution by North-West Corner rule for the following Transportation problem. The figures inside the table indicate the unit cost of transportation in rupees.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  | Destinations | | | | Availability | | Origins |  | D1 | D2 | D3 | D4 |  | | O1 | 11 | 9 | 7 | 10 | 120 | | O2 | 5 | 11 | 9 | 6 | 115 | | O3 | 4 | 7 | 8 | 6 | 210 | | O4 | 3 | 12 | 4 | 5 | 105 | | Requirement | | 95 | 115 | 140 | 200 | 550 | | CO2 | 10 |
| (OR) | | | | |  |
| 4. | a. | Explain the following three methods of solving Transportation problem:   1. North West Corner Rule 2. Least Cost Method 3. Vogel’s Approximation Method | CO1 | 8 |
|  | b. | Out of the three methods of getting an initial feasible solution for Transportation problem, which method gives a more accurate solution? Support your answer with reason. | CO2 | 2 |
|  | c. | Obtain the initial basic feasible solution by Vogel’s Approximation method for the following Transportation problem. The figures inside the table indicate the unit cost of transportation in rupees.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | Warehouses | | | Availability | | P | Q | R |  | | Plants | A | 13 | 11 | 8 | 30 | | B | 14 | 16 | 13 | 40 | | C | 12 | 10 | 12 | 30 | | Requirement | | 45 | 35 | 20 | 100 | | CO2 | 10 |
|  | | | | |
| 5. | a. | Define an Assignment Model | CO1 | 5 |
|  | b. | How will you solve an Assignment problem with Maximization objective? | CO2 | 5 |
|  | c. | A Machine Tool company decides to make four sub-assemblies through four contractors. Each contractor is to receive only one sub-assembly. The cost of each sub-assembly is determined by the bids submitted by each contractor ( in thousands of rupees)and is shown in the table below:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | Contractors | | | | |  |  | I | II | III | IV | | Sub-assemblies | A | 15 | 13 | 14 | 17 | | B | 11 | 12 | 15 | 13 | | C | 13 | 12 | 10 | 11 | | D | 15 | 17 | 14 | 16 |   Solve the problem using Hungarian Method and arrive at the optimal assignment | CO3 | 10 |
| (OR) | | | | |  |
| 6. | a. | What is a Sequencing problem? What are the assumptions made in it? | CO1 | 4 |
|  | b. | Explain the methodology of solving the sequencing problem of processing ‘n’ jobs through three machines | CO2 | 6 |
|  | c. | There are seven jobs, each of which has to go through the machines A and B in the order A → B. The processing time (in hours) are given below.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Job | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Machine -A | 3 | 12 | 15 | 6 | 10 | 11 | 9 | | Machine - B | 8 | 10 | 10 | 6 | 12 | 1 | 3 |   Determine the sequence of the jobs that will minimize the total elapsed time. Find the total elapsed time and the idle time for machines ‘A’ and ‘B’ | CO3 | 10 |
|  | | | | |
| 7. | a. | What are the reasons for the replacement of machines/equipments? What is the logic behind determining the replacement time? | CO1 | 5 |
|  | b. | Give an example for equipments that deteriorate gradually with the passage of time and for equipments that fail suddenly. | CO2 | 5 |
|  | c. | The cost of a machine is Rs. 61,000. And its scrap value is Rs. 1000. The maintenance costs assessed from experience are found to be as shown in the table below:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Maintenance Cost (Rs.) | 1000 | 2500 | 4000 | 6000 | 9000 | 12500 | 16000 | 20000 |   When should the machine be replaced? | CO3 | 10 |
| (OR) | | | | |  |
| 8. | a. | Define the following terms associated with Queuing Theory:   1. Waiting time in queue 2. Waiting time in the system 3. Service discipline 4. Balking 5. Reneging 6. Jockeying 7. Collusion 8. Poisson Distribution of Arrival rate 9. Exponential Distribution of Service time 10. Service Mechanism | CO1 | 10 |
|  | b. | In a railway yard, goods trains arrive at a rate of 30 trains/day. The arrival rate follows Poisson distribution. The trains are serviced at an average rate of 40 trains/day. The service time follows exponential distribution.   1. What is the average number of trains in the queue? 2. What is the average number of trains in the system? | CO2 | 10 |
|  |  |  |  |  |
| **Compulsory**: | | | | |
| 9. | a. | Define the term ‘Critical path’ in a Project scheduling network. | CO1 | 5 |
|  | b. | Distinguish between CPM and PERT. | CO1 | 5 |
|  | c. | Draw the network diagram for the given data and arrive at the Critical Path.   |  |  |  | | --- | --- | --- | | Activity | Immediate Predecessor | Duration (in months) | | A | - | 2 | | B | - | 6 | | C | - | 4 | | D | B | 3 | | E | A | 6 | | F | A | 8 | | G | B | 3 | | H | C , D | 7 | | I | C, D | 2 | | J | E | 5 | | K | F, G, H | 4 | | L | F, G, H | 3 | | M | I | 13 | | N | J, K | 7 | | CO3 | 10 |

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