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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **16MA2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **OPERATIONS RESEARCH** | **Max. marks :** | **100** |

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

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| --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | Emerson electric company produces two products A and B. Products are produced and sold on a weekly basis. The weekly production cannot exceed 25 for product A and 35 for product B because of limited available facilities. The company employs total of 60 workers. Product A requires 2 man-weeks of labour, while B requires one man week of labour. Profit margin on A is Rs.60 and on B is Rs.40.   1. Formulate the LP problem 2. Solve for maximum profit graphically. | CO1 | 20 |
| (OR) | | | | |
| 2. |  | Solve by Simplex method  Max Z = 3x1 + 2x2 + 5x3  Subject to  x1 + x2 + x3 ≤ 9  2x1 + 3x2 + 5x3 ≤ 30  2x1 – x2 – x3 ≤ 8  Where x1, x2 & x3 ≥ 0 | CO1 | 20 |
|  |  |  |  |  |
| 3. |  | Consider the following table involving three sources and four destinations as reproduced below. The cell entries represent the cost of transportation per unit.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | I | II | III | IV | **Supply** | | I | 3 | 1 | 7 | 4 | **300** | | II | 2 | 6 | 5 | 9 | **400** | | III | 8 | 3 | 3 | 2 | **500** | | **Demand** | **250** | **350** | **400** | **200** |  |   Obtain the initial basic feasible solution and then optimize the solution. | CO2 | 20 |
| (OR) | | | | |
| 4. | a. | Explain the application of MODI in Transportation problem. | CO2 | 10 |
| b. | What is degeneracy? Explain the steps to solve degeneracy in transportation problem. | CO2 | 10 |
|  |  |  |  |  |
| 5. |  | Find out how the task should be allotted to each subordinate so as to optimize the total man hours from the following details:  Task  I II III IV   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Subordinate 1 | 8 | 26 | 17 | 11 | | 2 | 13 | 28 | 4 | 26 | | 3 | 38 | 19 | 18 | 15 | | 4 | 19 | 26 | 24 | 10 | | CO2 | 20 |
| (OR) | | | | |
| 6. |  | Consider the problem of assigning four sales persons to four different sales regions as shown below, in such that the total sale is maximized.  Sales Region   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 1 | 2 | 3 | 4 | | Salesman 1 | 10 | 22 | 12 | 14 | | Salesman 2 | 16 | 18 | 22 | 10 | | Salesman 3 | 24 | 20 | 12 | 18 | | Salesman 4 | 16 | 14 | 24 | 20 |   The cell entries represent annual sales figures in lakhs of rupees. Find the optimal allocation of the sales persons to different region. | CO2 | 20 |
|  |  |  |  |  |
| 7. |  | Find the optimal strategies for the players and value of the following game.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | **Player B** | | | | |  |  | **1** | **2** | **3** | **4** | | **Player A** | **1** | 3 | 2 | 4 | 0 | | **2** | 3 | 4 | 2 | 4 | | **3** | 4 | 2 | 4 | 1 | | **4** | 3 | 4 | 3 | 4 | | CO3 | 20 |
| (OR) | | | | |
| 8. |  | Write a short note on:   1. Game Theory 2. Saddle Point 3. Two Person Zero Sum 4. Mixed Strategy 5. Maxmin principle | CO3 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | The arrival rate of customers at the single window booking counter of a two wheeler agency follows Poisson distribution and the service time follows exponential distribution. The arrival rate and service rate are 25 customers per hour and 35 customers per hour, respectively. Find the following:   1. Average number of waiting customers in queue. 2. Average number of waiting customers in the system. 3. Average waiting time per customer in the queue. 4. Average waiting time per customer in the system. 5. What is the probability of zero customers in the system? | CO3 | 10 |
| b. | Write a short note on   1. Queue Discipline 2. Single-channel Queuing System 3. Utilization Factor | CO3 | 10 |