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

G:\logo and QP Template\logo 3 Feb 2018 final.tif

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

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

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** |  | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure contain nutrient constituents (call them X, Y and Z), it is necessary to buy two additional products, say, A and B. one unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. one unit of Product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs.20 per unit and Product B Rs.40 per unit.  Formulate the above as a linear programming problem to minimize the total cost, and solve the problem by using graphical method. | CO1 | 20 |
| (OR) | | | | |
| 2. |  | Solve by two phase method  Minimize Z = x1 + x2  Subject to  2x1 + x2 ≥ 4  x1 + 7x2 ≥ 7  where x1 & x2 ≥ 0. | CO1 | 20 |
| 3. |  | A product is manufactured by four factories A, B, C and D. Unit transportation cost, in rupees, from each factory to each store is given in the table below.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | | Stores | | | | Availability | | 1 | 2 | 3 | 4 | | Factory | A | 4 | 6 | 8 | 13 | 50 | | B | 13 | 11 | 10 | 8 | 70 | | C | 14 | 4 | 10 | 13 | 30 | | D | 9 | 11 | 13 | 8 | 50 | | Demand | | 25 | 35 | 105 | 20 |  |   Determine the optimum transportation cost for this company to minimize the transportation costs. | CO2 | 20 |
| (OR) | | | | |
| 4. |  | 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 | | 2 | 16 | 18 | 22 | 10 | | 3 | 24 | 20 | 12 | 18 | | 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 |
| 5. |  | Provide the optimal job sequence and idle time in each machine involving three machines in the order M1, M2 and M3 for the following five jobs J1, J2, J3, J4 and J5. The processing time in each machine is also given.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Job | J1 | J2 | J3 | J4 | J5 | | Machine M1 | 7 | 12 | 11 | 9 | 8 | | Machine M2 | 8 | 9 | 5 | 6 | 7 | | Machine M3 | 11 | 13 | 9 | 10 | 11 | | CO2 | 20 |
| (OR) | | | | |
| 6. |  | A repair shop attended by a single mechanic has an average of four customers an hour who bring small appliances for repair. The mechanic inspects them for defects and can quite often fix them right away or otherwise render a diagnosis. This takes him six minutes on an average. Arrivals are Poisson and service time has exponential distribution. You are required to   1. Find the proportion of time during which the shop is empty. 2. Find the probability of finding at least one customer in the shop. 3. What is the average number of customers in the system? 4. Find the average time spent, including service. 5. Find the probability that number of customers are 5 in the system. | CO3 | 20 |
| 7. |  | Consider the following table summarizing the details of a project involving 11 activities.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Activity | Predecessor(s) | Duration (weeks) | | | | a | m | b | | A | - | 6 | 7 | 8 | | B | - | 1 | 2 | 9 | | C | - | 1 | 4 | 7 | | D | A | 1 | 2 | 3 | | E | A,B | 1 | 2 | 9 | | F | C | 1 | 5 | 9 | | G | C | 2 | 2 | 8 | | H | E,F | 4 | 4 | 4 | | I | E,F | 4 | 4 | 10 | | J | D,H | 2 | 5 | 14 | | K | I,G | 2 | 2 | 8 |  1. Construct the project network. 2. Find the expected duration and variance of each activity. 3. Find the critical path and the expected project completion time. 4. What is the probability of completing the project on or before 25 weeks? 5. If the probability of completing the project is 0.84, find the expected project completion time. | CO2 | 20 |
| (OR) | | | | |
| 8. |  | There are two players in a game, Player A and player B. Each of them randomly shows selected fingers of his right hand. If the sum of the number of fingers shown by both the players is an even number, then the player B has to give money in rupees equivalent to the number of fingers shown by him to the player A; if the sum of the number of fingers shown by both the players is an odd number, then the player A has to give money in rupees equivalent to the number of fingers shown by him to the Player B. Construct the matrix with respect to the player A and find the optimal solution for this game. | CO3 | 20 |
| **Compulsory:** | | | | |
| 9. |  | Consider the data of a project as shown in the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Activity | Normal | | Crash | | | Time (days) | Cost (Rs.) | Time (days) | Cost (Rs.) | | 1-2  1-3  2-4  2-5  3-4  4-5 | 8  4  2  10  5  3 | 100  150  50  100  100  80 | 6  2  1  5  1  1 | 200  350  90  400  200  100 |   If the indirect cost is Rs.70 per day, find the optimal crashed project completion time. | CO3 | 20 |