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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **14MS3014** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED 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. |  | | Transportation 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. | CO1 | 20 |
| 3. |  | | 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 and x3 ≥ 0 | CO1 | 20 |
| (OR) | | | | | |
| 4. |  | | Solve the following assignment problem using Hungarian Method. The cell entries represent the time in hours to cover the subjects. Find the optimal allocation of faculties in such a way that the time is minimized.  Subject  1 2 3 4 5   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Faculty 1 | 30 | 39 | 31 | 38 | 40 | | 2 | 43 | 37 | 32 | 35 | 38 | | 3 | 34 | 41 | 33 | 41 | 34 | | 4 | 39 | 36 | 43 | 32 | 36 | | 5 | 32 | 49 | 35 | 40 | 37 | | 6 | 36 | 42 | 35 | 44 | 42 | | CO2 | 20 |
| 5. |  | | Two machine-tool companies, A and B competing for supplying a CNC lathe to a new factory. Each company has listed its alternatives/ strategies for selling machine tools. The strategies of Company A are as listed below.  i. Giving special price ii. Give 15% worth of additional tools iii. Supplying some work holding device free of cost.  The strategies/ alternatives of Company B are as follows:  i. Giving special price ii. Giving 20% worth of additional tools iii. Giving free training to the users of the organization which is buying the machine.  The estimated gains (+)/ losses (–) in lakhs of rupees of Company A for various combinations of the alternatives of both the companies are summarized in the following table. Find the optimal strategies for each of the companies.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Company A |  | Company B | | | | 1 | 2 | 3 | | 1 | 40 | 45 | 50 | | 2 | 20 | 45 | 60 | | 3 | 25 | 30 | 30 | | CO2 | 20 |
| (OR) | | | | | |
| 6. | a. | | 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 | | CO3 | 10 |
|  | b. | | Write a short note on  i. Slack Variable, ii. Artificial Variable, iii. Queuing Behaviour, iv. Unbound solution and v. two-person zero-sum game | CO3 | 10 |
| 7. |  | | Vehicles pass through a toll gate at a rate of 90 per hour. The average time to pass through the gate is 36 seconds. The arrival rate and service rate follow Poisson distribution. There is a complaint that the vehicles wait for long duration. The authorities are willing to install one more gate to reduce the average time to pass through the toll gate to 30 seconds if the idle time of the toll gate is less than 10 % and the average queue length at the gate is more than 5 vehicles. Check whether the installation of the second gate is justified. | CO3 | 20 |
| (OR) | | | | | |
| 8. |  | Construct the network for the project whose activities and the their time estimates of these activities (in weeks) are given below. Calculate   1. Expected duration for each activity. 2. Expected variance of each activity. 3. Expected variance and standard deviation of the project length. 4. What is the probability that the project is completed in 25 days?  |  |  |  |  | | --- | --- | --- | --- | | Activity | to | tm | tp | | 1-2  2-3  2-4  3-5  4-5  4-6  5-7  6-7  7-8  7-9  8-10  9-10 | 3  1  2  3  1  3  4  6  2  1  4  3 | 4  2  3  4  3  5  5  7  4  2  6  5 | 5  3  4  5  5  7  6  8  6  3  8  7 | | | CO2 | 20 |
| **Compulsory:** | | | |  |  |
| 9. |  | CPM Construct the network for the project whose activities are given below and compute the total, free and independent float of each activity and hence determine the critical path and the project duration.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activity | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 | | Duration  in days | 3 | 8 | 12 | 6 | 3 | 3 | 8 | 5 | 3 | 8 | | | CO2 | 20 |

ALL THE BEST