

Date:07-03-2022

Registration number:

**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**BCA - V SEMESTER**

**SEMESTER EXAMINATION: OCTOBER 2021**

**(Examination conducted in January-March 2022)**

**CA 5418 - Operations Research**

Time- 2 ½ hrs Max Marks-70

This question paper contains three parts

**Part A**

**Answer all the following questions (10\*2=20)**

1. What is the objective of Operation Research?
2. Mention any two methods for solving Operation Research problem.
3. What is the main goal of transportation problem?
4. What are the assumptions we consider for solving transportation problem?
5. Define Slack and Surplus Variables.
6. What is Total float? Write the mathematical formula for it.
7. How is Hungarian method applied if matrix is rectangular?
8. Define the following terms.
9. Fair Game
10. Strategy
11. What is the rule to determine the saddle point?
12. What do you mean by earliest start time for an activity in a PERT network? Write its mathematical formula.

**PART B**

**Answer any Five of the following questions (5\*6=30)**

1. Solve the following LPP by graphical method:

Maximize Z=100 x+60 y

subject to the constraints 5x+10y<=50

8x+2y>=16

3x-2y>=6

where x,y>=0

1. After completing the construction of his house Mr Jacob discovers that 100 sq. ft of plywood and 80 sq. ft of white pipe scrap are not used. He made tables and bookshelves out of them. It took 16 sq. ft of plywood and 8 sq. ft of white pipe scrap to make tables and 12 sq. ft of plywood and 16 sq. ft of white pipe scrap to make book shelves. By selling the finished product to a local furniture store he gets Rs 25 profit on each table and Rs 20 on each book shelf. Formulate the above LPP to find his maximum profit.
2. Use Vogel’s Approximation method to find the initial basic feasible solution for the following transportation problem.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DESTINATION** | | | | | | |
| **SOURCE** |  | **A** | **B** | **C** | **D** | **SUPPLY** |
| **1** | 11 | 20 | 7 | 8 | **50** |
| **2** | 21 | 16 | 20 | 12 | **40** |
| **3** | 8 | 12 | 18 | 9 | **70** |
|  | **DEMAND** | **30** | **25** | **35** | **40** |  |

1. a. How do you find the optimal solution in a transportation problem? [2+4]

b. Determine the initial basic feasible solution for the following transportation problem using North West Corner rule.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **DESTINATION** | | | | | | | | |
| **SOURCE** |  | **1** | **2** | **3** | **4** | **5** | **SUPPLY** |
| **A** | 2 | 11 | 10 | 3 | 7 | **4** |
| **B** | 1 | 4 | 7 | 2 | 1 | **8** |
| **C** | 3 | 9 | 4 | 8 | 12 | **9** |
|  | **DEMAND** | **3** | **3** | **4** | **5** | **6** |  |

1. The assignment cost of assigning any one operator to any one machine is given in the following table. Find the optimal assignment schedule and also mention the method used.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **MACHINE** | **OPERATOR** | | | | |
|  | **A** | **B** | **C** | **D** |
| **1** | 10 | 12 | 19 | 11 |
| **2** | 5 | 10 | 7 | 8 |
| **3** | 12 | 14 | 13 | 11 |
| **4** | 8 | 15 | 18 | 9 |

1. Consider a project with activities A, B, C, D, E and F. The following table shows the precedence and duration (in days) of each of the activities. Draw the project network diagram.

|  |  |  |
| --- | --- | --- |
| **ACTIVITY** | **PREDECESSORS** | **DURATION (DAYS)** |
| A | -- | 10 |
| B | A, F | 15 |
| C | E | 8 |
| D | A, B, E | 10 |
| E | A | 12 |
| F | -- | 7 |

1. The following table represents the payoff matrix with respect to player A. Solve it optimally to find the saddle point and the value of the game .

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PLAYER A** | **PLAYER B** | | | | | |
|  | **1** | **2** | **3** | **4** | **5** |
| **1** | 4 | 6 | 5 | 10 | 6 |
| **2** | 7 | 8 | 5 | 9 | 10 |
| **3** | 8 | 9 | 11 | 10 | 9 |
| **4** | 6 | 4 | 10 | 6 | 4 |

**PART C**

**Answer any two of the following questions (2\*10=20)**

1. a. Find the initial basic feasible solution of the following transportation problem by North West corner rule method

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | D1 | D2 | D3 | D4 | SUPPLY |
| S1 | 3 | 1 | 7 | 4 | 250 |
| S2 | 2 | 6 | 5 | 9 | 350 |
| S3 | 8 | 3 | 3 | 2 | 400 |
| DEMAND | 200 | 300 | 350 | 150 |  |

b. Optimize the above solution using UV method/MODI's method. [5+5]

19. Consider the details of a project as shown in the table below and [5+5]

1. Construct the CPM network.
2. Determine the **critical path** and **project completion time**.

|  |  |  |
| --- | --- | --- |
| **ACTIVITY** | **IMMEDIATE PRECEDENCE** | **DURATION(Months)** |
| A | - | 2 |
| B | - | 5 |
| C | - | 4 |
| D | B | 5 |
| E | A | 7 |
| F | A | 3 |
| G | B | 3 |
| H | C, D | 6 |
| I | C, D | 2 |
| J | E | 5 |
| K | F, G, H | 4 |
| L | F, G, H | 3 |
| M | I | 12 |
| N | J, K | 8 |

20.a. Mention any for phases of Operation Research. [4+6]

b. Solve the following LPP.

Maximize *Z*= 2 *x*1 +3*x*2

subject to constraints *x*1 + *x*2 ≤ 30; *x*2 ≤ 12; *x*1 ≤ 20

and *x*1,*x*2≥ 0

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*