**CSC 1500 – Homework 9**

**(1)** Use the Inverse Matrix method to solve the following system of linear equations. (20 pts.)

**3X + Z = 31**

**2X – 2Y + Z = 7**

**Y + 3Z = -9**

**MATRIX:**

|  |  |  |
| --- | --- | --- |
| **3** | **0** | **1** |
| **2** | **-2** | **1** |
| **0** | **1** | **3** |

**INVERTED MATRIX:**

|  |  |  |
| --- | --- | --- |
| **7/19** | **-1/19** | **-2/19** |
| **6/19** | **-9/19** | **1/19** |
| **-2/19** | **3/19** | **6/19** |

**\***

|  |
| --- |
| **31** |
| **7** |
| **-9** |

**=**

|  |
| --- |
| **12** |
| **6** |
| **-5** |

**X = 12, y=6, z=-5**

**(2)** Please use the Hungarian Method for finding the optimal assignment of jobs to workers. (20 pts.)

Abigail charges 12 dollars for Yardwork, 25 dollars for Repairs, and 20 dollars for Painting.

Bich charges 3 dollars for Yardwork, 5 dollars for Repairs, and 16 dollars for Painting.

Caleb charges 4 dollars for Yardwork, 10 dollars for Repairs, and 18 dollars for Painting.

You want all three jobs done for the cheapest total amount possible between these three workers.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Yardwork | Repairs | Painting |
| Abigail | 12 | 25 | 20 |
| Bich | 3 | 5 | 16 |
| Caleb | 4 | 10 | 18 |

From each row subtract each row’s minimum value from everything on the row.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Yardwork | Repairs | Painting |
| Abigail | 0 | 13 | 8 |
| Bich | 0 | 2 | 13 |
| Caleb | 0 | 6 | 14 |

AFTER STEP 1: From each column, subtract that column’s minimum value INCLUDING ZEROES

|  |  |  |  |
| --- | --- | --- | --- |
|  | Yardwork | Repairs | Painting |
| Abigail | 0 | 11 | 0 |
| Bich | 0 | 0 | 5 |
| Caleb | 0 | 4 | 6 |

Cover the zeroes with as few lines as possible.

A red line on a white background

Description automatically generated

This suggests that Caleb should be doing yardwork, Bich should be doing repairs, and Abigail should be doing painting.

The following graph will be used for problems 3 & 4

A triangle with black dots and black lines with Great Pyramid of Giza in the background

Description automatically generated

**(3)** Draw out the Minimum Spanning Tree of the above graph. *(10 pts.)*

*A black and white drawing of a number and points

Description automatically generated*

Figure 1 – Minimum Spanning Tree for Question 3

**(4)** Using Dijkstra’s Algorithm, determine the shortest path from A to E, and the shortest path from A to F. (*20 pts.)*

*AE – 10 - > B 4*

*AF – 8 ->D 7 ->B 4*

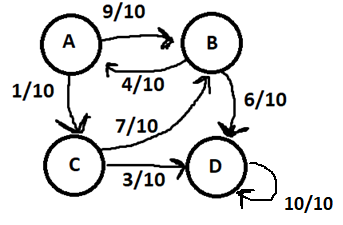
**(5)** Create an adjacency Matrix for the following directed graph. (*10 pts.*)

A diagram of a diagram

Description automatically generated

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G |
| A | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| B | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| C | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| D | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| F | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| G | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

**(6)** Create an adjacency Matrix for the following Markov Chain, then please square the Matrix, and then state the odds of getting from A to D in TWO MOVES. (*20 pts.*)



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | D |
| A | 0 | 0.4 | 0 | 0 |
| B | 0.9 | 0 | 0.7 | 0 |
| C | 0.1 | 0 | 0 | 0 |
| D | 0 | 0.6 | 0.3 | 1 |

Table 6-1 Adjacency Matrix

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | D |
| A | 0.36 | 0 | 0.28 | 0 |
| B | 0.07 | 0.36 | 0 | 0 |
| C | 0 | 0.04 | 0 | 0 |
| D | 0.57 | 0.6 | 0.72 | 1 |

Table 6-2 Squared Adjacency Matrix

There is a 57% chance of going from A to D in two moves if starting at A.