

# Minimum Spanning Tree Determination Program Using Kruskal Algorithm on Visual Basic 6.0

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**Abstract:** *Minimum spanning tree has been used to solve several problem, such as cost saving in electrical installation. Electrical instalation design is described in weighted graph form. the weighted graph value is a cable length. to find a minimum spanning tree in this research, the Kruskal algorithm is used. Kruskal algorithm Procedure will be describe in a flow chart. then according to the flowchart, a program designed with visual basic 6.0. this research will produce a program to solve minimum spanning tree with the Kruskal algorithm on visual basic 6.0 application support. test the program to solve one of problems. This application is divided many form such as menu form , description form, input form, and matrix and tree form.*

**Keywords:** Minimum Spanning Tree, Kruskal's Algorithm, Microsoft Visual Basic 6.0

## 1. Introduction

The problem is the gap between expectation and events. The most people usually expect the comfort and more profits, which is one factor of the onset of problems, such as the installation of an electric current. Someone who install electrical currents expect efficient results and using the smallest cost. the installation of electrical wiring electrical current is used as a transmitter of kwh meter flow to each room that requires electricity. The optimal using of the power cord is one way to decrease the cost of installing an electric current, thats means for channeling the flow of electricity use cable with minimum length but does not reduce the efficiency of its functions.

One method of graph theory which can be used to optimize the use of electrical wiring is minimum spanning tree, The Utilization of a method of minimum spanning tree on optimizing the use of electrical wiring done by representing the electricity network will be installed into the form of a weighted graph, afterwards from a weighted graph that made multiple spanning tree, and then select the spanning tree that has the smallest weight.

Determination of the minimum spanning tree in this research used Kruskal algorithm. The steps formally Kruskal algorithm can be written as follows:

1. Fill T with all point G without the side.
2.  $m=0$
3. For  $m < (n-1)$  do
  - a. Determine edge  $e \in E$  with minimum weight, if there are several e with the characteristics arbitrarily pick one.
  - b. Remove e from E
  - c. If e is added to T does not produce circuit then
  - d. Added e to T
  - e.  $m = m+1$

Determination of the minimum spanning tree with Kruskal algorithm can be done manually, but to find the minimum spanning tree in a graph that has many nodes and many sides manually is very difficult and takes a long time, so in this research designed a program to facilitate the search for minimum spanning tree. This is done by translating the

Kruskal algorithm that determines the minimum spanning tree into a flowchart, flow chart is then designed a program using Microsoft Visual Basic 6.0.

## 2. Research Methods

This research is basic research (theoretical). The method used is descriptive method that is based on the study of literature and the results of analysis of some theories that are relevant to the issues discussed.

The research method in this study is to review issues relating to the minimum spanning tree and then collect several theories that support this study as graph theory, representation of graphs, minimum spanning tree, Kruskal algorithm and the Microsoft Visual Basic 6.0, then connected several theories are relevant already found with issues discussed, then proceed with the design of this study program on the visual Basic 6.0 applications to facilitate the determination of the minimum spanning tree algorithm using Kruskal. and the the final is testing the program that has been designed to the problems.

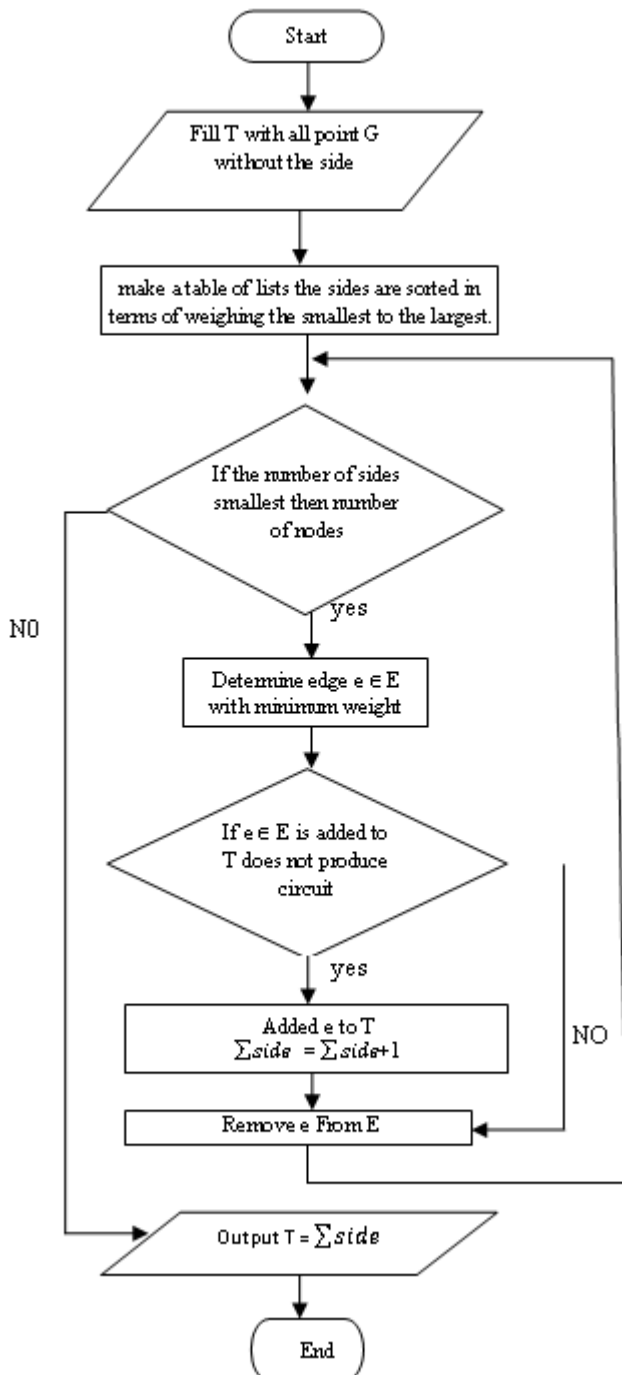
## 3. The Determination of Minimum Spanning Tree Determination Using Kruskal Algorithm

The explanation steps of Kruskal algorithm to determining the minimum spanning tree are

- 1) Issues to be discussed are described to form a simple weighted graph is not directed
- 2) Created a table that lists the sides and weights, from a simple weighted graph is not directed has been described in step 1, and then list on the side of the table are sorted in terms of weighing the smallest to the largest.
- 3) All points covering the graph depicted without including all sides to form an empty graph.
- 4) The sides are weighing the smallest on the table that was created in step 2 is made so that it connects two points on the blank graph above.
- 5) Side and the weight that was used in Step 4 is removed from the table.

- 6) Repeat step 4 on the condition that the graph does not form a circuit.
- 7) If the graph is shaped circuit then go to step 5
- 8) Repeat steps 4 to the number of edges in the graph is one less than the number of vertices.
- 9) because the number of trees is one less than the number of vertex then the Kruskal algorithm processing is stopped when the graph has numbered of sides less than one vertex and the formed graph is a picture of a minimum spanning tree problems.

Based on the above translation can be flowchart of Kruskal algorithm in determining the minimum spanning tree to a graph. The flowchart is descript as follow as



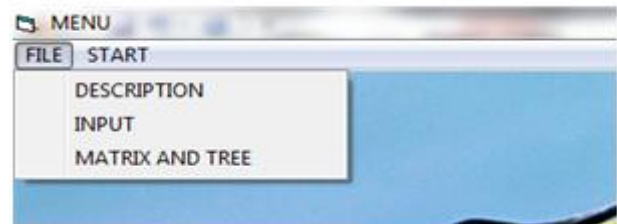
**Figure 1:** Flow Chart

## 4. Minimum Spanning Tree Determination Program Using Kruskal Algorithm

The design of the application visual basic program usually begins by activating the visual basic IDE (integrated development environment) and select the type of project that is needed in making the program. In the research project have been standard .exe project that contains a standard menu for use in making program. In this research the addition of the form it takes more than one to design a user interface that is more appealing to users. Some form used in this research as follows

### 4.1 Menu Form

This form is used as the display form first appeared when the program is run, with the objective form of this menu can display some the next form found on the program. In the upper this form is given two main options that will be the user's choice. The first choice with writing files have the primary goal when users hover over to file will display some form name that will appear as the *description*, *input*, *matrix & trees*. If the user clicks the cursor on the name of the form, then the users see the form that corresponds to the name of the form. Furthermore, the second option that reads *Start* have the primary goal when the user selects this option, the program will display the *description form*.



**Figure 2:** Menu Form

### 4.2 Description Form

This form is designed to describe the name of the program before the user starts entering data. This form is equipped with the Next button so that when the user selects the button then the application will display the next form is *Input form*



**Figure 3:** Description Form

### 4.3 Input Form

**Figure 4:** Input Form

This form is designed in such a way to input the number of vertices and sides (the link between the node with another node) and weighs both sides that connect these nodes. On this form also given frame *named Connection Edges*, the frame was given several labels are:

- 1) Label2 given by writing *Initial Vertex* that mean the white box located directly beside label2 as a write user initial node name.
- 2) Label3 given by writing *End Vertex*, that mean the white box located right beside pengguna Label3 can be used as a place to write down the name of the destination node.
- 3) Label4 given by writing *Edge* that means white box that is located right next to Label4 is where users write down the number of edges connecting the node cloud and the destination node.
- 4) Label5 given by writing weights, that means the white box located directly beside Label5 is where users write down the value of the weight of the side that connects the cloud node with the destination node.

On this frame was given 4 Command Button that have different functions are:

**1) Save**

This Command Button is designed to store data that has been entered into the database. In this program, the database using Microsoft Access as a data base.

**2) Delete**

This ommand Button is designed to erasing data that has been entered

**3) Process**

This Command Button is designed to make the process of establishing minimum spanning tree according Kruskal algorithm of graph that has been entered, in addition to the Command Button also displays the number and total weight of the minimum spanning tree that produced.

**4) Matrix**

Command Button is designed to display a matrix of minimum spanning tree through a text box that is located in form a matrix and trees.

This form is also laid on the DataGridView associated with Adodc1. Adodc1 designed to connect the DataGridView with data base so that the DataGridView can display the data that has been entered in the data base. As illustrated form input data can be seen in Figure 4.

**4.4 Matrix and Tree Form**

This form is placed on the box as a text box to display a matrix of minimum spanning tree, and Command Button with the words *tree* that is designed to display images from the minimum spanning tree in the picture box located below the text box. Ilustarsi form can be seen in Figure 6.

**Figure 5:** Matriks and Tree Form

**5. Program Test**

In this research tested program to solve the problems of optimal electrical wiring on a design house that will be built. According to plan, the rooms in the house to be built given the lighting in parallel, the house will also be equipped with a fuse and an electrical control mbc that each room in the house.

The house design is given a mark on some of the places that need electricity. In the picture given sign becomes a node in a graph, then the node can be withdrawn from the side as a symbol of the possibility of cable to be installed. At home there are six rooms that require electricity.

Optimizing the use of electrical wiring in the home design above can be done by establishing a minimum spanning tree. before the establishment of the minimum spanning tree electrical design is planned for the first house depicted in graph form. As for drawing graphs of the electrical design of the house can be seen in Figure 7

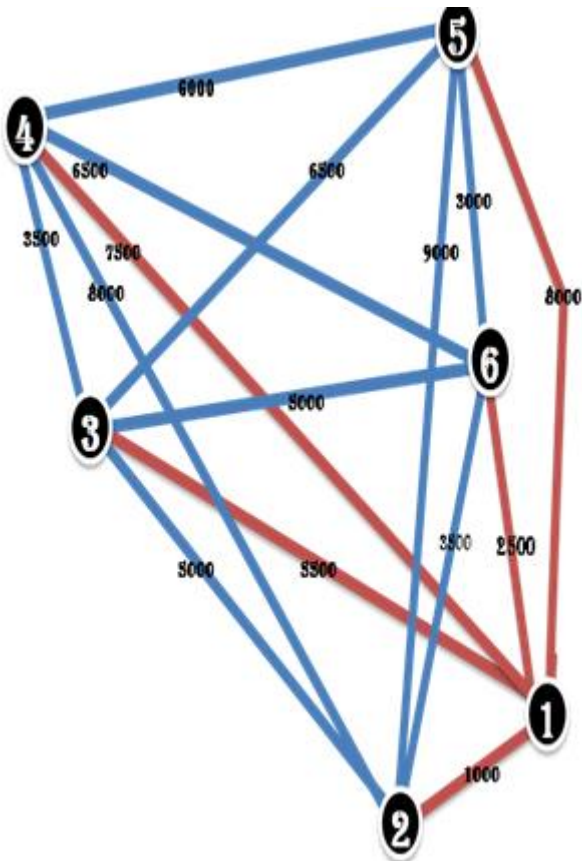


Figure 6.: Electric Cable Network

ID	Initial Vertex	End Vertex	Edge	Weight	Number Of Vertex
279	2	4	1	8000	6
280	2	5	1	9000	6
281	2	6	1	3500	6
282	3	4	1	3500	6
283	3	5	1	6500	6
284	3	6	1	5000	6
285	4	5	1	6000	6
286	4	6	1	6500	6
287	5	6	1	3000	6
288	1	4	1	7500	6

Number of edges from the initial matrix = 15  
 Total weight of the initial matrix = 80500  
 Number of edges from the MST = 5  
 Total weight of the MST = 15000

Figure 7.: Input Form

Figure 8.: Matrix And Tree

In the picture 7 is looks the epitome of a point with numbers. At the point bearing the number 1 is the location of a fuse, so each side of the connecting point bearing the number 1 to the other points are given marks in red. While the point that no other bearing the number 1 is some place that requires electric current. Side connecting points that do not relate directly to the point of bearing the number 1 is marked in blue

The search results minimum spanning tree of the graph is by using a program that has been dirancan in this article can be seen in Figure 8. Then settlement matrix and the minimum spanning tree image can be seen in the picture 9. Jadi after processing using the program it was decided that the minimum length cable required to illuminate the 6 rooms of the house along the 15000 cm, or 15 meters.

## 6. Conclusion

- 1) Program determining minimum spanning tree with Kruskal algorithm using applications Visual Basic 6.0 consists of 4 pieces Form are form a menu that contains a list of list forms that exist in the program, the form description as a form that describes the title of the program, form data input as a user input data on the number knot and the connectedness between the two points and the weight of the sides and finally forms the matrix as the program displays the output in the form of a matrix and the minimum spanning tree weight value of the graph.

- 2) The program is designed to determine the minimum spanning tree according to Kruskal algorithm steps are sorting based on the weight of the small to the large. And then made empty graft covering all points on the graph, and then selected by the smallest weight, but does not form a loop with sides that have been chosen earlier.

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