5. Graph Files and MST Construction

# Assignment (Project 11.1 from page 411 of our text)

Design a format for storing graphs in a file. Then implement two functions: one to read a graph from a file and the other to write a graph to a file (your input and output graph files should be in the same format). Test your functions by implementing a complete MST program that reads an undirected graph from a file, constructs the MST, and then writes to a second file the graph representing the MST. For this assignment you must incorporate smart pointers to get full credit.

# Additional Instructions

Run your program using the graph represented in the following adjacency matrix:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 |  |  | 7 |  | 9 |  |
| 1 |  |  | 5 |  |  | 6 |
| 2 | 7 | 5 |  | 3 |  | 2 |
| 3 |  |  | 3 |  |  | 2 |
| 4 | 9 |  |  |  |  | 1 |
| 5 |  | 6 | 2 | 2 | 1 |  |

Build three (3) MSTs by changing your starting vertex. Use the following three vertexes for your starting vertex:

* 0
* 4
* 2

Your terminal output (as opposed to your file output) should look something like the following:

Number of vertices is \_\_

Number of edges is \_\_

Matrix is:

0 0 7 0 9 0

0 0 5 0 0 6

7 5 0 3 0 2

0 0 3 0 0 2

9 0 0 0 0 1

0 6 2 2 1 0

Begin MST 1 starting at Vertex 0

Add edge 0 to 2

Add edge 2 to 5

Add edge 5 to 4

Add edge 5 to 3

Add edge 2 to 1

0 0 7 0 0 0

0 0 5 0 0 0

7 5 0 0 0 2

0 0 0 0 0 2

0 0 0 0 0 1

0 0 2 2 1 0

End of MST 1

Begin MST 2 starting at Vertex 4

… etc., etc. etc.

# Submit

* Graph files (initial file and the three MST files you create).
* Executable file (should run off your initial file and produce the three MST files)
* All the source files used to produce your solution.
* A Word document which details your approach. In this document be sure to tell me which files you’ve used from our text that you have modified and what those modifications are.
* Text file or Word document with screen shot(s) with your program’s output.
* Word document with screen shot showing your program actually runs (this is only necessary if you submitted a text file for your output above).

# Rubrics

* Output showing the original graph (as read from the input file) and at least the first MST produced by starting at vertex 0 to get any credit at all.
* Graph files – your program must read an initial graph file and produce at least 1 MST file to get credit for this portion of the assignment. Both your input and output graph files must be in text format so that I can read them.
* Correctly produced MSTs as documented by your program’s output.

|  |  |
| --- | --- |
| **Requirements** | **%Value** |
| Read graph file and display results | 10% |
| Produce 1st MST starting at vertex 0 | 40% |
| Produce 2nd MST starting at vertex 4 | 20% |
| Produce 3rd MST starting at vertex 2 | 10% |
| Write 1st MST to file | 3% |
| Write 2nd MST to file | 3% |
| Write 3rd MST to file | 3% |
| Smart Pointers Used? | 5% |
| Approach Document? | 5% |

[Course Learning Outcomes Alignment](https://drive.google.com/file/d/1xyx8tEoeW3u_6n81hDY3GLjI5zvgpQ5c/view?usp=sharing)