

Project 2

[New Attempt](#)

- Due 25 Jun by 23:59
- Points 120
- Submitting a file upload

Project 2: Graph Algorithms and Related Data Structures

Singles-source shortest path algorithm and Minimum Spanning Tree (MST)

Note: You can work alone or in a team of TWO max.

Problem 1: Single-source Shortest Path Algorithm

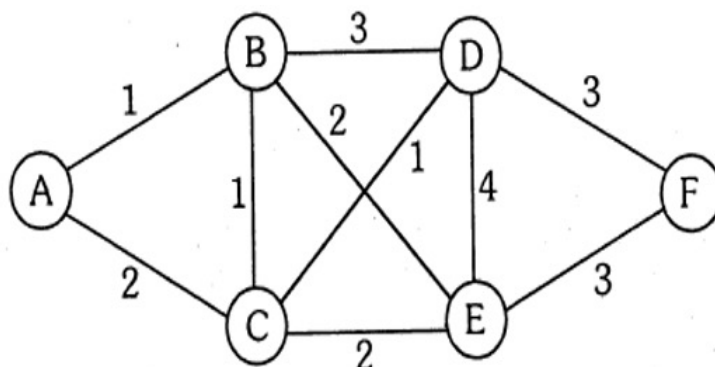
Find shortest path tree in both directed and undirected weighted graphs for a given source vertex. Assume there is no negative edge in your graph. You will print each path and path cost for a given source.

Problem 2: Minimum Spanning Tree Algorithm

Given a connected, undirected, weighted graph, find a spanning tree using edges that minimizes the total weight $w(T) = \sum_{(u,v) \in T} w(u,v)$. Use either Kruskal's or Prim's algorithm to find Minimum Spanning Tree (MST). You will printout edges of the tree and total cost of minimum spanning tree.

Input Format:

For each problem, you will take input from a text file. Say you want to run algorithm on the following undirected graph.



The corresponding file format would be:

```

6 10 U
A B 1
A C 2
B C 1
B D 3
B E 2
C D 1
C E 2
D E 4
D F 3
E F 3
A

```

Here, the first two numbers represent the number of vertices and edges. The letter U stands for undirected graph (D for directed). From the second line, it mentions all edges and its weight (e.g. **edge(A, B)** and its weight is 1. The last line is optional. If given, it represents the source node.

If you prefer different input format, you can do so. But must provide enough details so that TA can run your program easily.

Program Execution:

For each algorithm, run your program for **FOUR different graphs** of your choice. Use your judgement to define test graphs that you think interesting and reasonable. For example:

- Undirected graph: at least 9 nodes and 12 edges
- Directed graph: at least 7 nodes and 15 edges

Grading Scheme:

Shortest path in directed or undirected graphs (50)		
	Give pseudocode and detail analysis of runtime	15
	Clearly mention data structures used and how it affects the runtime of algorithm	10
	Implementation of shortest path finding algorithm in directed/undirected graphs	15
	Test on four different graphs and showing paths and path cost	$4 \times 2.5 = 10$
Minimum spanning tree (50)		
	Give pseudocode and detail analysis of runtime	15
	Clearly mention data structures used and how it affects the runtime of algorithm	10
	Implementation of minimum spanning tree algorithm	15
	Test on four different graphs and printing tree edges and cost	$4 \times 2.5 = 10$
Flexibility in running your project such as input graph taken from a text file		10
Quality of report		10
Total		120

Submission Instructions:

- Submit a well-formatted report covering a short description of each algorithm, data structure chosen, **detail** analysis of runtime, sample input/output, instruction to run your program easily. **Follow the grading scheme given above and write report accordingly.**
- Upload error free code to run.
 - You can use programming languages like C/C++, Java, Python, or C#.

Late Submission Penalty:

- If you need a few extra days, take prior approval.
- Otherwise:
 - For each extra day 10 points penalty.
 - No submission will be accepted after three days of deadline.