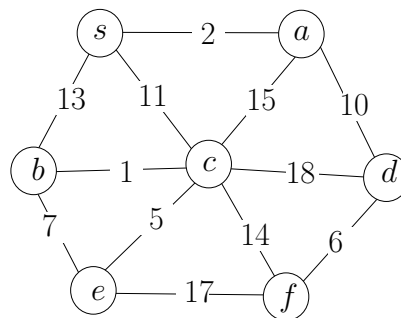


Homework 5*Instructor: Shi Li***Deadline: 11/27/2022**

Your Name: _____ Your Student ID: _____

Problems	1	2	3	Total
Max. Score	25	25	30	80
Your Score				

Problem 1. Consider the following graph G with non-negative edge weights. Use

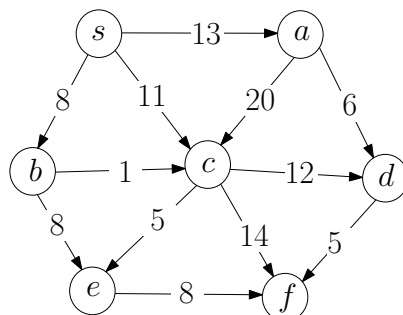
Prim's algorithm to compute the minimum spanning tree of G . You need to use the following table to describe the execution of the algorithm and give the minimum spanning tree and its weight.. If $d[v] = \infty$, then $\pi[v] = \perp$. Also, when a vertex v has been added to S , you can leave its d and π values empty, to make the table clean (but it is not required to do so).

iteration	vertex added to S in iteration i	a		b		c		d		e		f	
		d	π	d	π	d	π	d	π	d	π	d	π
1	s	2	s	13	s	11	s	∞	\perp	∞	\perp	∞	\perp
2													
3													
4													
5													
6													
7													

Table 1: Prim's Algorithm for Minimum Spanning Tree

The edges in the MST are _____.
 Its weight is _____.

Problem 2. Consider the following directed graph G with non-negative edge weights. Use Dijkstra's algorithm to compute the shortest paths from s to all other vertices in G .



You need to fill the following table, and give the shortest path from s to f , and its length. When $d[v] = \infty$, we set $\pi[v] = \perp$. Also, when a vertex v has been added to S , you can leave its d and π values empty, to make the table clean (but it is not required to do so).

iteration i	vertex added to S in iteration i	a		b		c		d		e		f	
		d	π	d	π	d	π	d	π	d	π	d	π
1	s	13	s	8	s	11	s	∞	\perp	∞	\perp	∞	\perp
2													
3													
4													
5													
6													
7													

Table 2: Dijkstra's algorithm for Shortest Paths

The shortest path from s to f is _____.
Its length is _____.

Problem 3. We are given an undirected graph $G = (V, E)$ with non-negative edge weights $(w_e)_{e \in E}$. Assume all the weights are different and G is connected.

- (3a) True or False: The minimum spanning tree of G is unique. Justify your answer.
- (3b) Let s and t be two distinct vertices in V . True or False: The shortest path from s to t in G is unique. Justify your answer.

By justifying your answer, we mean the following: If the answer is yes, you need to give a proof. If your answer is no, you need to give a counter-example.