Q1 Academic Honesty

1 Point

It is a violation of the Academic Integrity Code to look at any reference material other than your textbook and lecture notes, or to give inappropriate help to someone or to receive unauthorized aid by someone in person or electronically via messaging apps such as WhatsApp. Academic Integrity is expected of all students of Hacettepe University at all times, whether in the presence or absence of members of the faculty. Do NOT sign nor take this exam if you do not agree with the honor code.

Understanding this, I declare I shall not give, use or receive unauthorized aid in this examination.

Signature (Specify your name and surname as your signature)

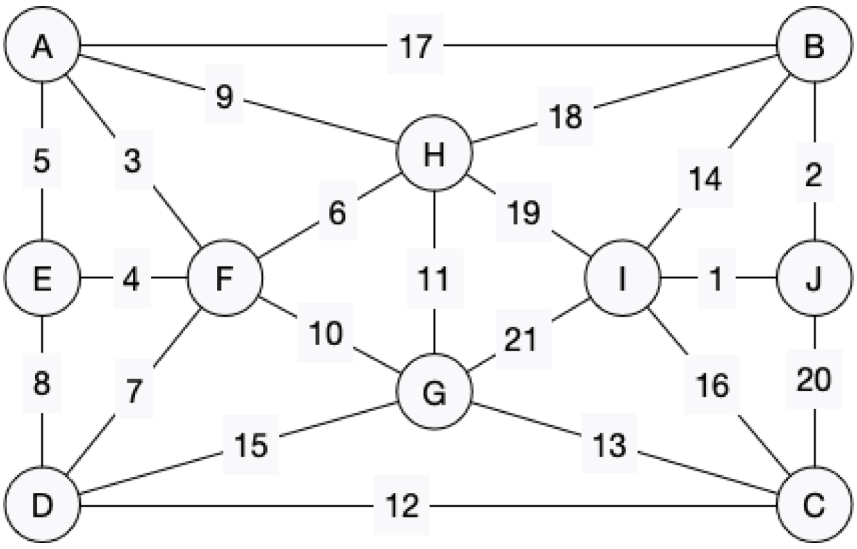
Mehmet Taha USTA MTUSTA

While answering the following questions, please consider the implementations that we discussed in our lectures unless stated otherwise.

Q2

36 Points

Consider the following edge-weighted graph with 10 vertices and 21 edges. Note that the edge weights are distinct integers between 1 and 21.



Q2.1

18 Points

Use Kruskal's algorithm to find a minimum spanning tree for the given graph, and list the edges in the order in which you add them to your minimum spanning tree by specifying their edge weights. **That is, your answer should be a sequence of numbers separated by whitespace, e.g. 11 2 8 ....**

1 2 3 4 6 7 10 12 16

Q2.2

18 Points

Use Prims's algorithm **starting from vertex C** to find a minimum spanning tree for the given graph, and list the edges in the order in which you add them to your minimum spanning tree by specifying their edge weights. **That is, your answer should be a sequence of numbers separated by whitespace, e.g. 11 2 8 ....**

12 7 3 4 6 10 16 1 2

Q3

30 Points

TRUE/FALSE

Q3.1
6 Points

Prim'salgorithm uses the Union-Find data structure.

- ○ True
- ◉ False

Q3.2
6 Points

Prim's algorithm runs asymptotically faster than Kruskal's on sparse graphs.

- ○ True
- ◉ False

Q3.3
6 Points

Prim's algorithm is a greedy algorithm but Kruskal's algorithm is not.

- ○ True
- ◉ False

Q3.4
6 Points

Any shortest path tree for a connected graph G is a spanning tree.

- ◉ True
- ○ False

Q3.5
6 Points

Consider that T is a minimum spanning tree on a graph G with weights $w(u, v) \in W$. If the weights of all the edges in the G have changed as follows:

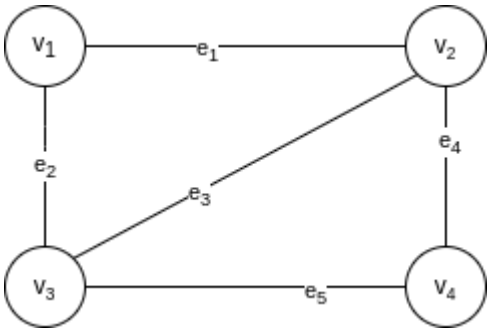
$$w(u,v) = \begin{cases} 2 * w(u,v) & \text{if } w(u,v) > 100 \\ 0 & \text{if } w(u,v) \leq 100 \end{cases}$$

The tree T is still a minimum spanning tree of the graph.

- (●) True
- ( ) False

Q4

14 Points



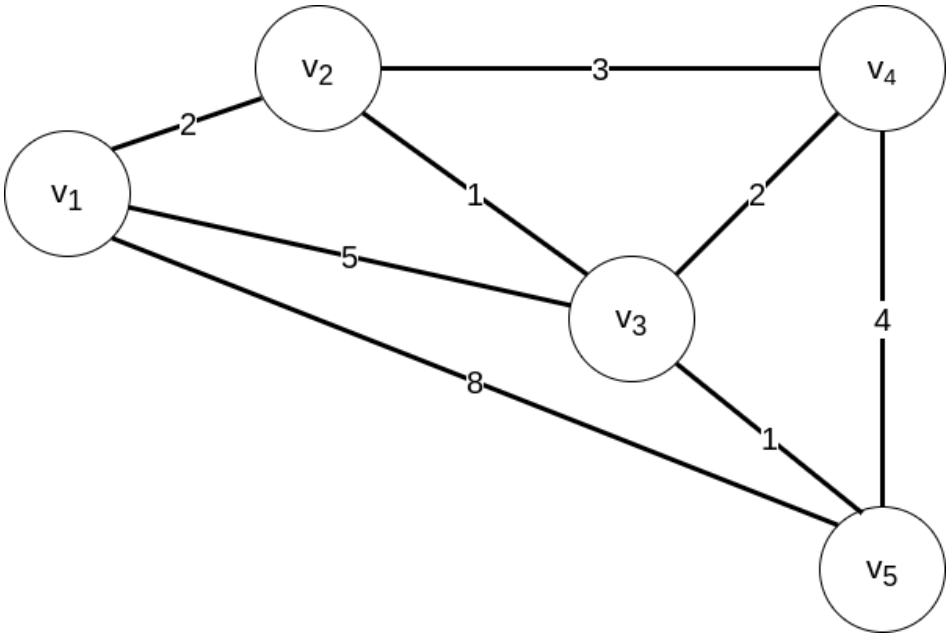
Kruskal and Prim's algorithms both grow the minimum spanning tree by adding an edge at a time. For which edge weights given below does these two algorithms add the same edges in the same order to the MST. Assume that both the vertices and adjacency lists are processed with respect to the indices of the vertices.

- ( ) $e_1 = 5, e_2 = 6, e_3 = 4, e_4 = 2, e_6 = 3$
- ( ) $e_1 = 2, e_2 = 5, e_3 = 8, e_4 = 6, e_6 = 3$
- (●) $e_1 = 2, e_2 = 4, e_3 = 8, e_4 = 3, e_6 = 5$
- ( ) $e_1 = 3, e_2 = 2, e_3 = 4, e_4 = 5, e_6 = 1$

Q5

20 Points

Eager and Lazy versions of the Prim's algorithm both depend on priority queues. Maximum number of elements in this priority queue determines the space complexity. Write down the maximum queue size for the following graph. Assume that both the vertices and adjacency lists are processed with respect to the indices of the vertices.



Q5.1

10 Points

The maximum queue size in Lazy version of Prim's algorithm

6

Q5.2

10 Points

The maximum queue size in Eager version of Prim's algorithm

4

Quiz 3 - Minimum Spanning Trees

GRADED

STUDENT
Mehmet Taha Usta

TOTAL POINTS
85 / 101 pts

QUESTION 1

Academic Honesty		**1** / 1 pt

QUESTION 2

(no title)		**36** / 36 pts
2.1	(no title)	**18** / 18 pts
2.2	(no title)	**18** / 18 pts

QUESTION 3

(no title)		**30** / 30 pts
3.1	(no title)	**6** / 6 pts
3.2	(no title)	**6** / 6 pts
3.3	(no title)	**6** / 6 pts
3.4	(no title)	**6** / 6 pts
3.5	(no title)	**6** / 6 pts

QUESTION 4

(no title)		**14** / 14 pts

QUESTION 5

(no title)		**4** / 20 pts
5.1	(no title)	**0** / 10 pts
5.2	(no title)	**4** / 10 pts