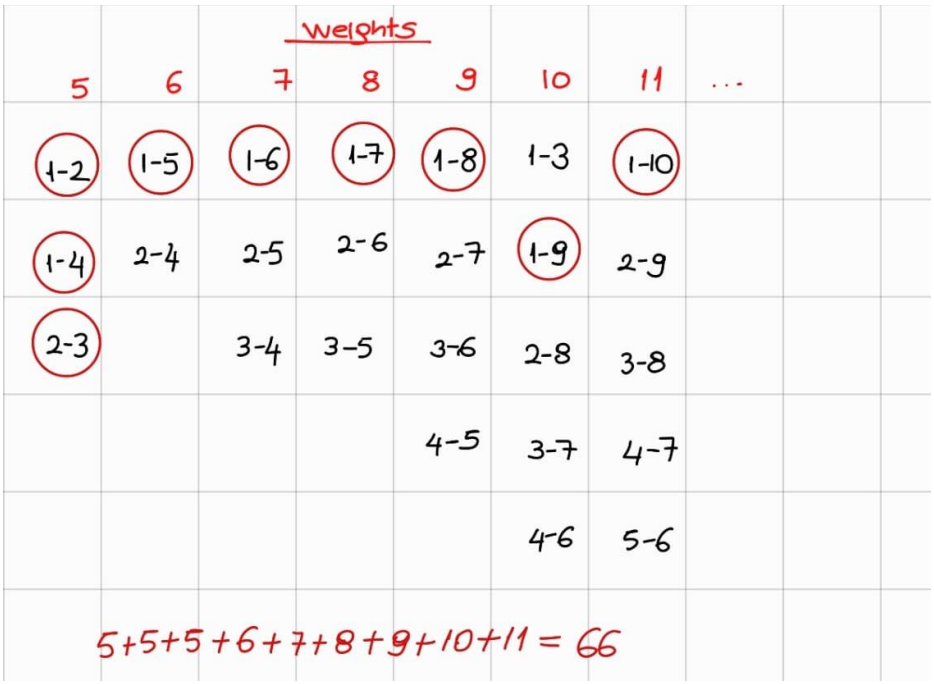
CS202 Homework 4

Hilal Coşgun

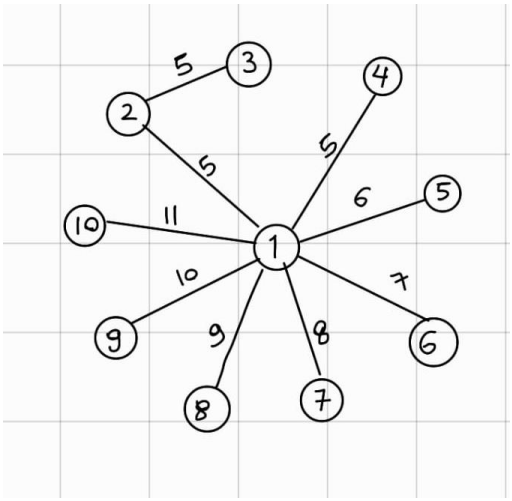
22201571

Question 1:

I used Kruskal's Algorithm to find minimum spanning tree. To use Kruskal's Algorithm, first, I grouped edges by their weights in ascending order. To find weights of edges, I applied the given formulas; $i^2 + j^2$ formula for edges (1,2) and (1,4), and i+j for remaining edges. Then I selected edges with smaller weights as long as they do not create a cycle. For example, after choosing (1,2), (1,4), (2,3) and (1,5), adding the edge (2,4) would create a cycle because both vertices 2 and 4 are already connected through other edges in the MST. Therefore, we do not select this edge. When all 9 edges are selected, which is number of vertices-1, I stopped and sum the weights. The total weight of the edges is 66.



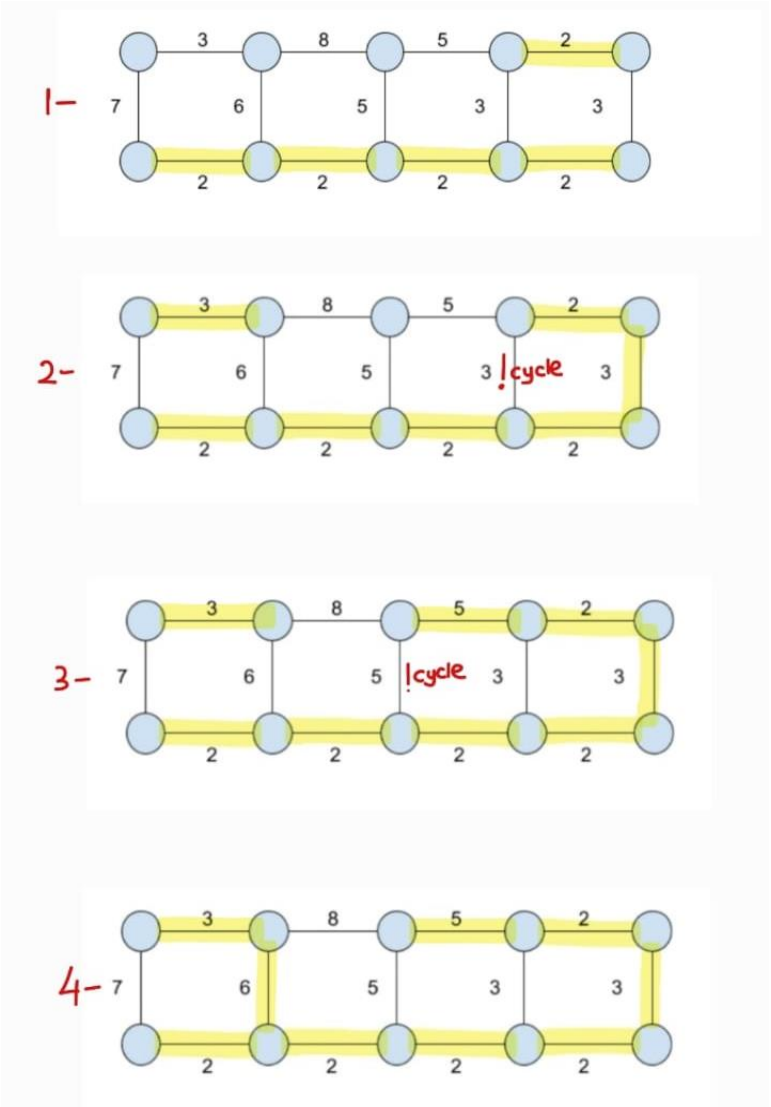
Final look of the MST:



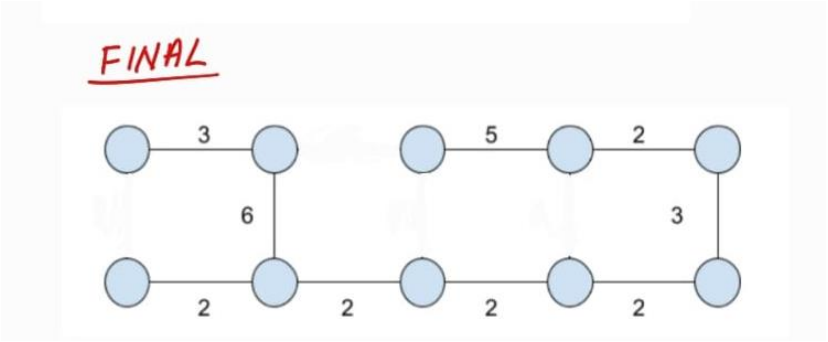
Question 2:

For this question, I again used Kruskal's Algorithm, as it is a widely preferred algorithm for constructing MSTs in weighted graphs. There are 10 vertices; therefore, 9 edges are needed for constructing a MST.

1- I started by selecting edges with the smallest weight of 2.
2- Then, I started to select the edges with weight of 3. However, I excluded one of the edges of weight of 3 to avoid creating a cycle.
3- Next, I selected edges with weight of 5. Again, I avoided making a cycle by adding only one of the edges with weight 5. Here, choice of which edge to select was arbitrary.
4- Finally, I selected an edge with weight 6, completing the MST with all 9 edges.



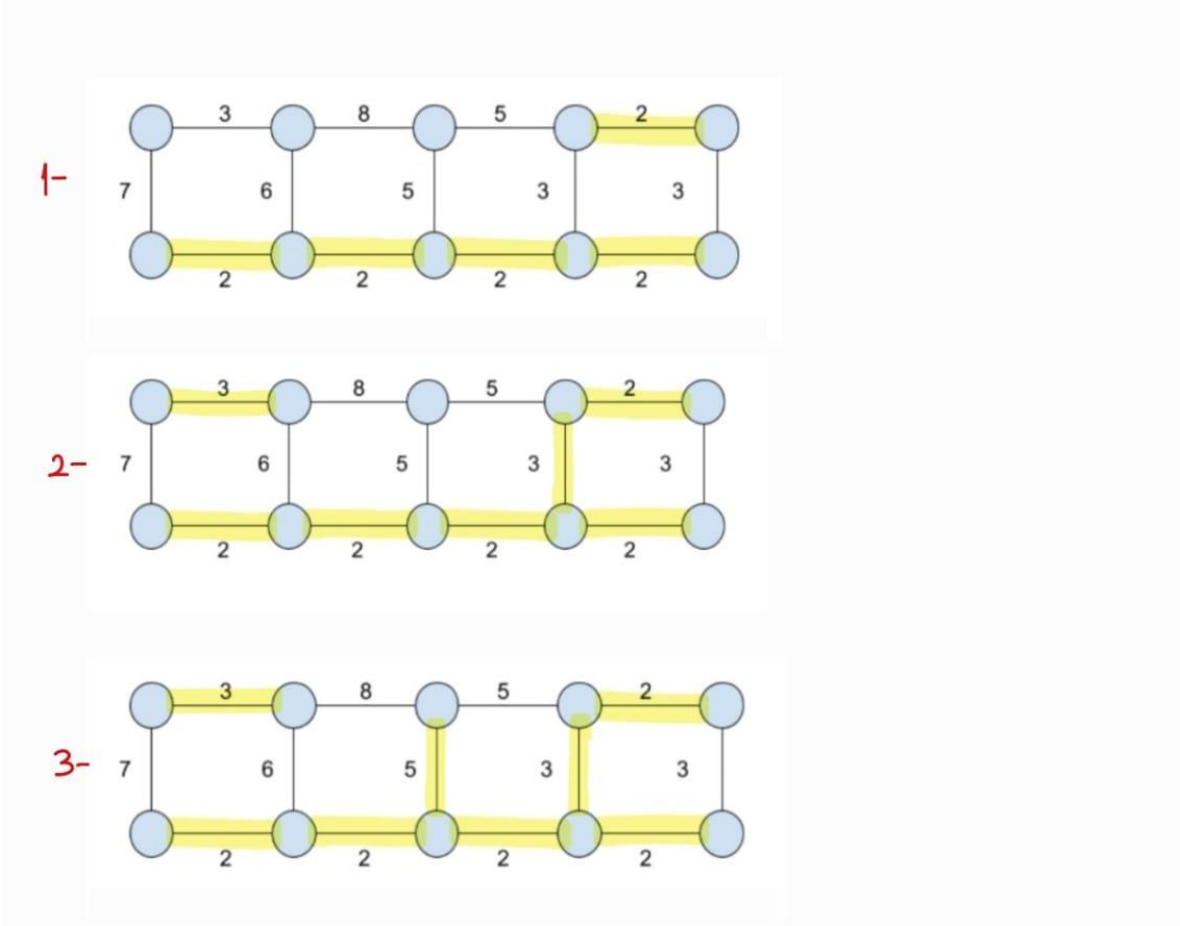
The final look of the MST here:



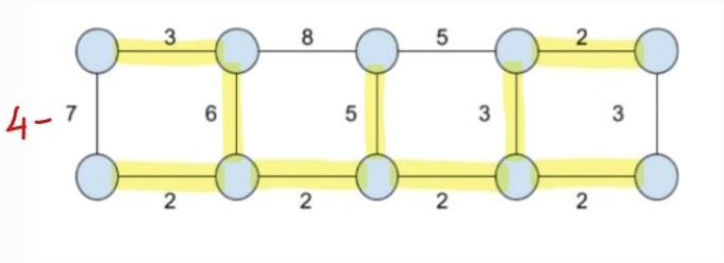
Total cost of wiring = 2.5+3.2+5+6 = 27

As I mentioned, to avoid cycles, I made some arbitrary decisions between edges. I also drew an alternative MST that includes different edge choices, and it can be seen that the total cost remains the same.

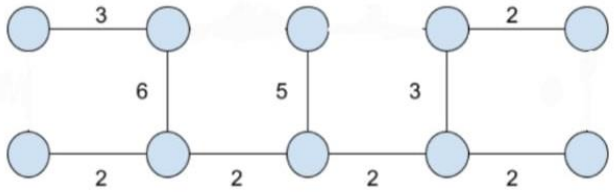
Alternative MST:



4-



FINAL



Total weight= $2 \cdot 5 + 3 \cdot 2 + 5 + 6 = 27$