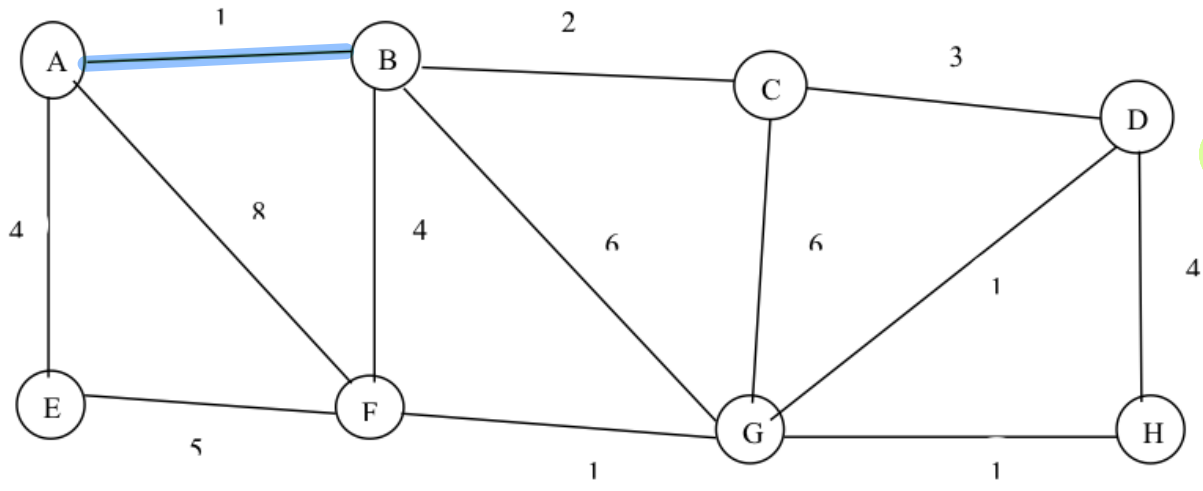
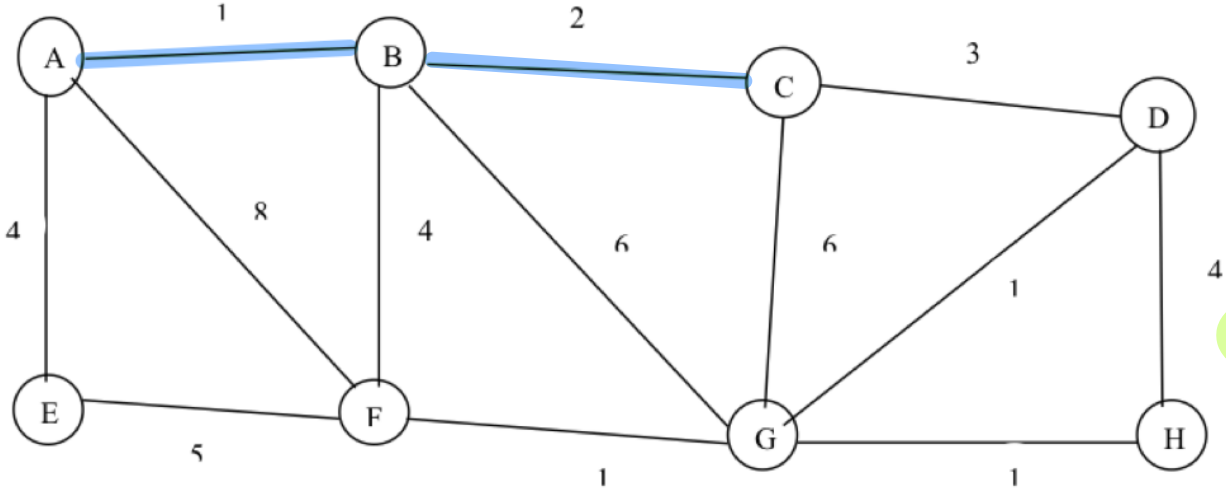
OCS 25 - Data Structures and Algorithms
Programming Assignment - 4
Minimum Spanning Trees

1. Prim's Algorithm

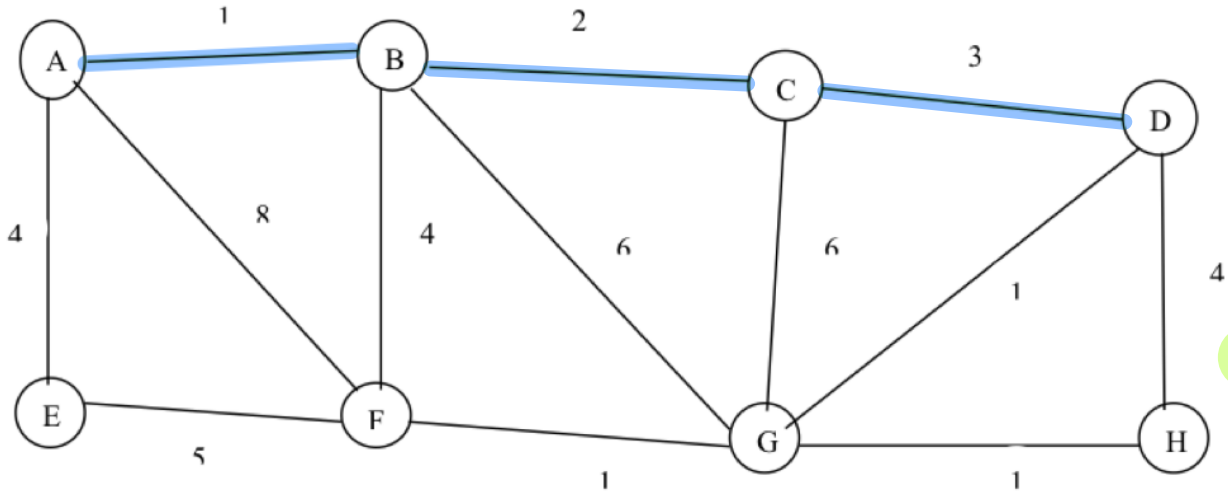
Run Prim's algorithm; whenever there is a choice of nodes, always use alphabetic ordering. Start a table showing the immediate values of the **cost** array.



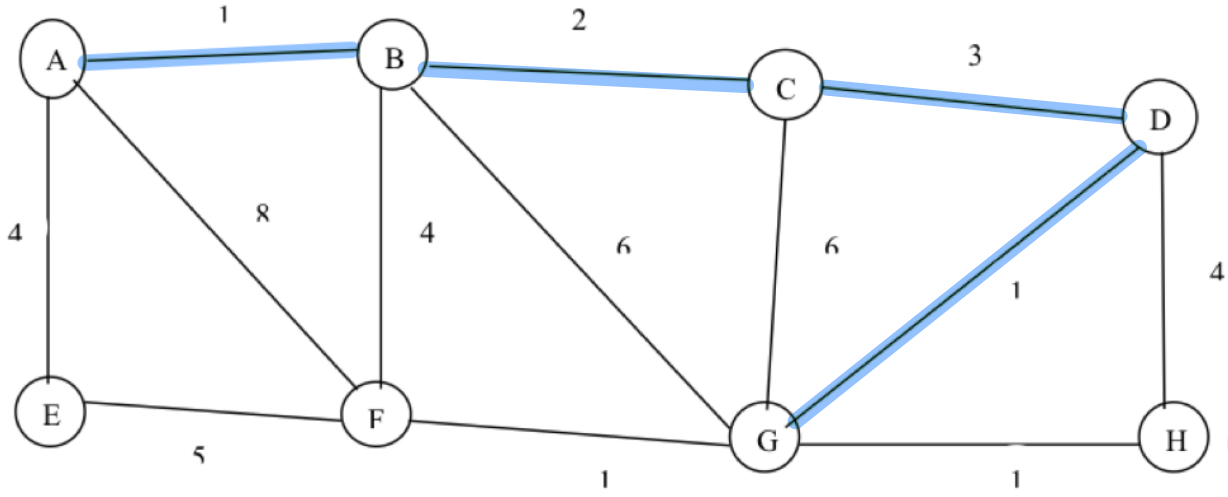
Edges	Weights
A-E	4
A-F	8
B-C	2
B-F	4
B-G	6



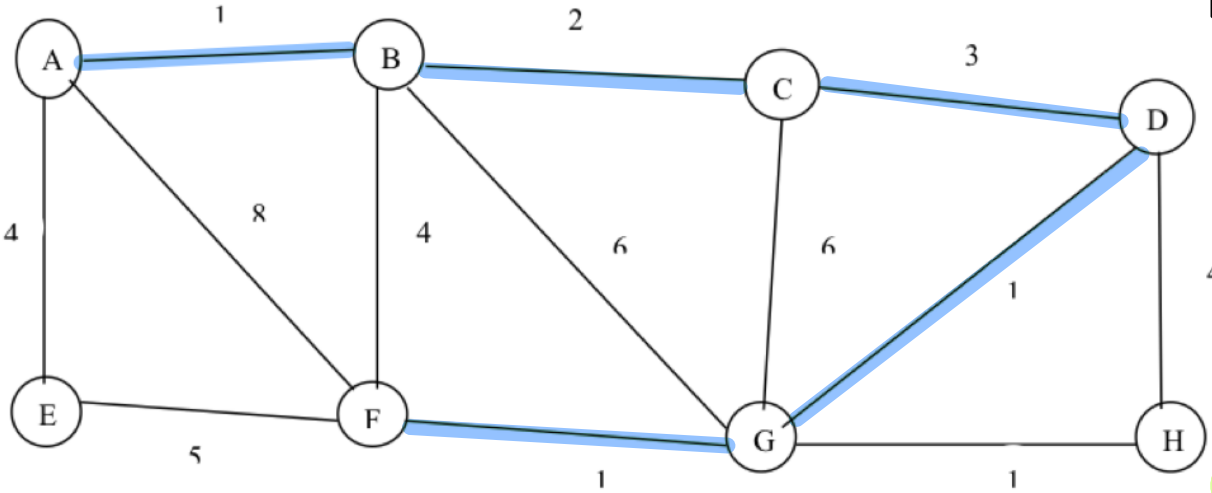
Edges	Weights
A-E	4
A-F	8
B-F	4
B-G	6
C-D	3
C-G	6



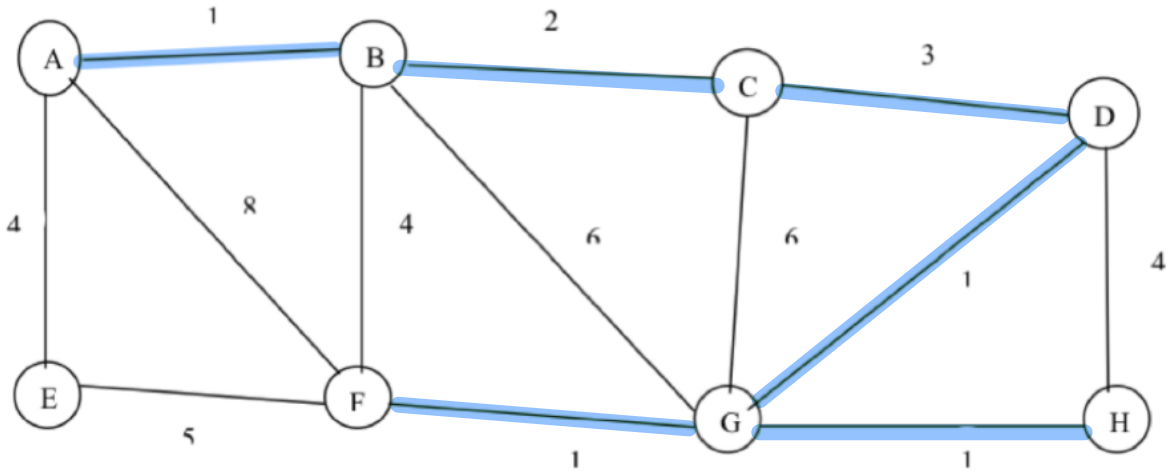
Edges	Weights
A-E	4
A-F	8
B-F	4
B-G	6
C-G	6
D-G	1
D-H	4



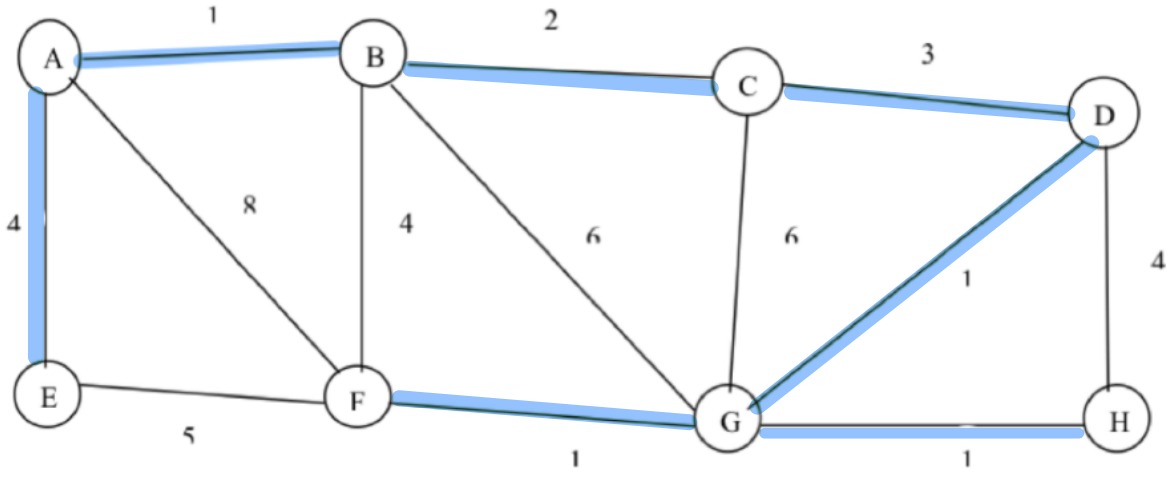
Edges	Weights
A-E	4
A-F	8
B-F	4
B-G	6
C-G	6
D-H	4
G-F	1
G-H	1



Edges	Weights
A-E	4
A-F	8
B-F	4
B-G	6
C-G	6
D-H	4
G-H	1
F-E	5



Edges	Weights
A-E	4
A-F	8
B-F	4
B-G	6
C-G	6
D-H	4
E-F	5

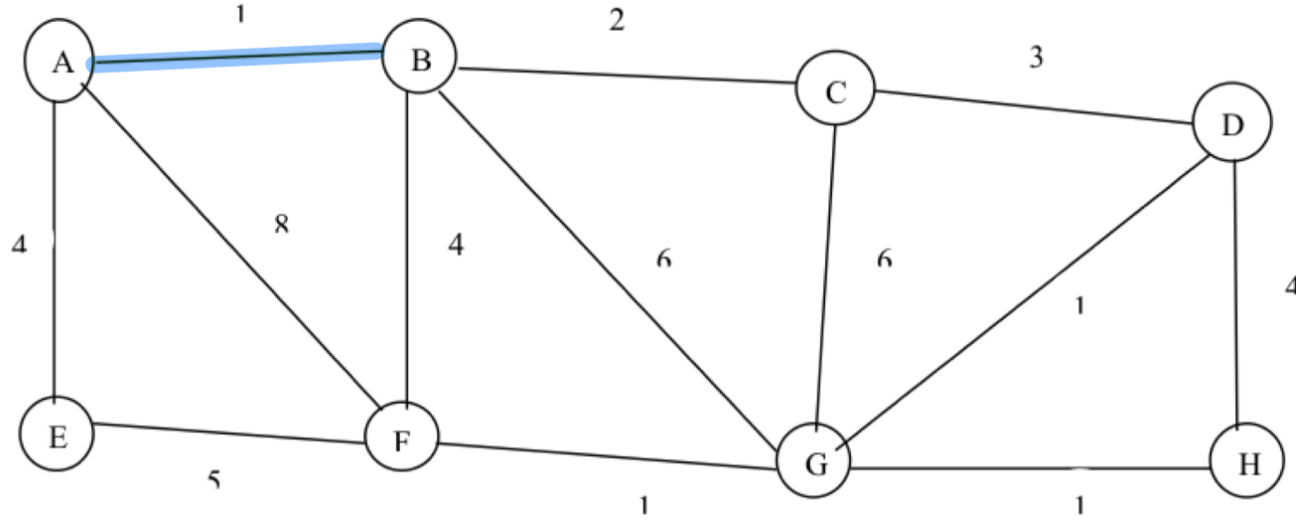


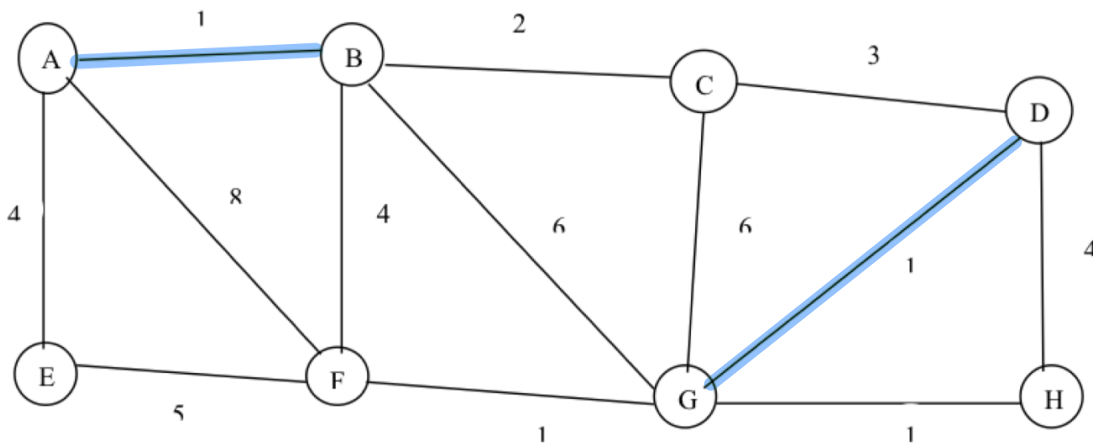
Stop. V-1 edges are marked.

Cost = 1+4+2+3+1+1
Minimum Cost = 13

2. Kruskals's Algorithm

Run Kruskals's algorithm on the above graph. Show the disjoint-sets at every intermediate stage, including the structure of the directed trees.

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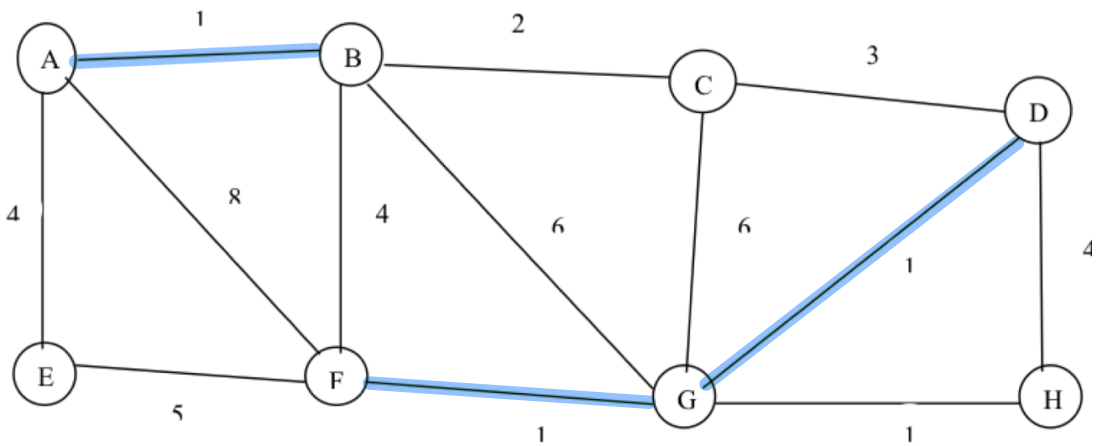
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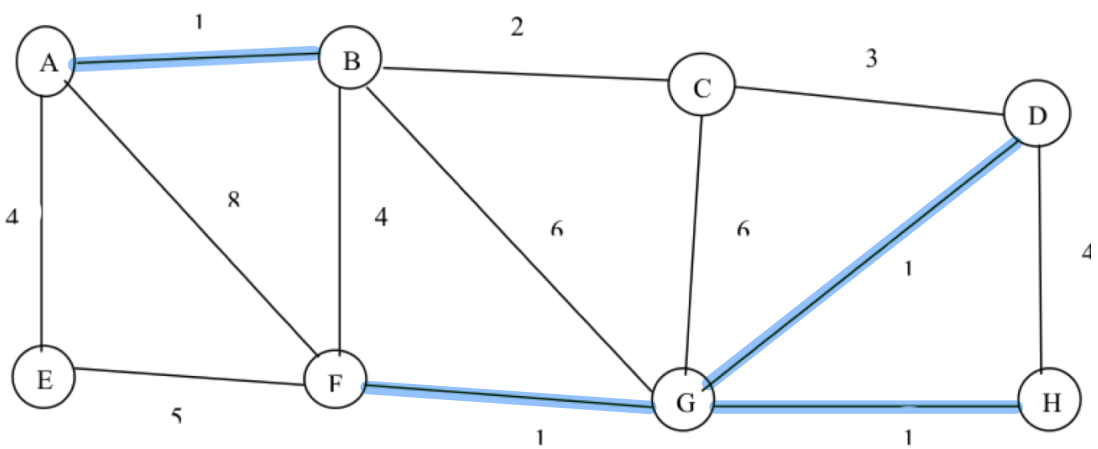
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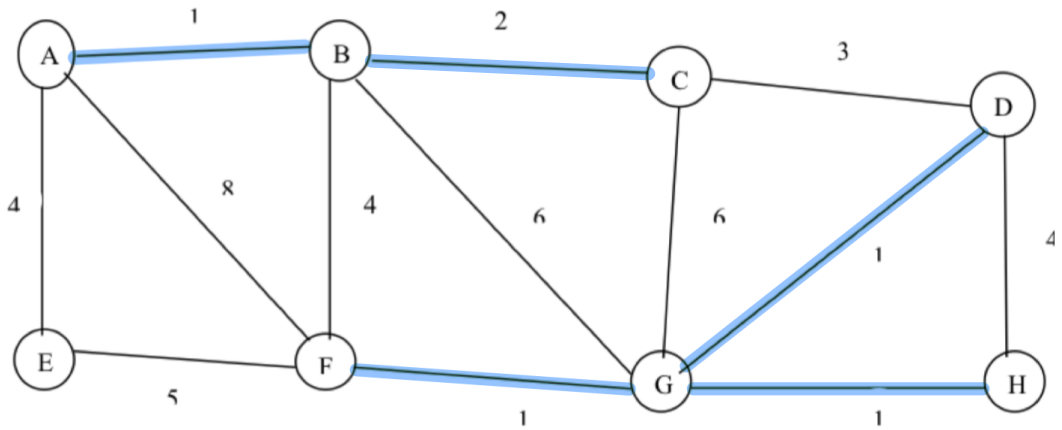
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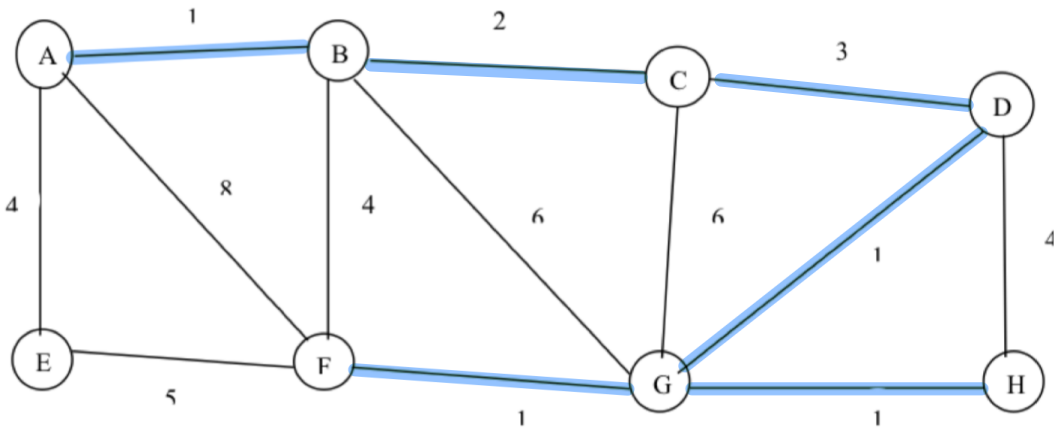
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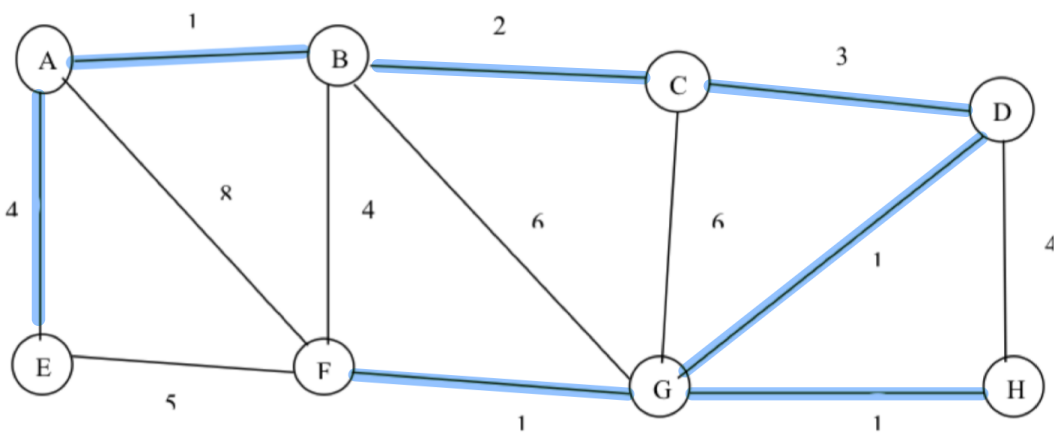
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Programming Assignment

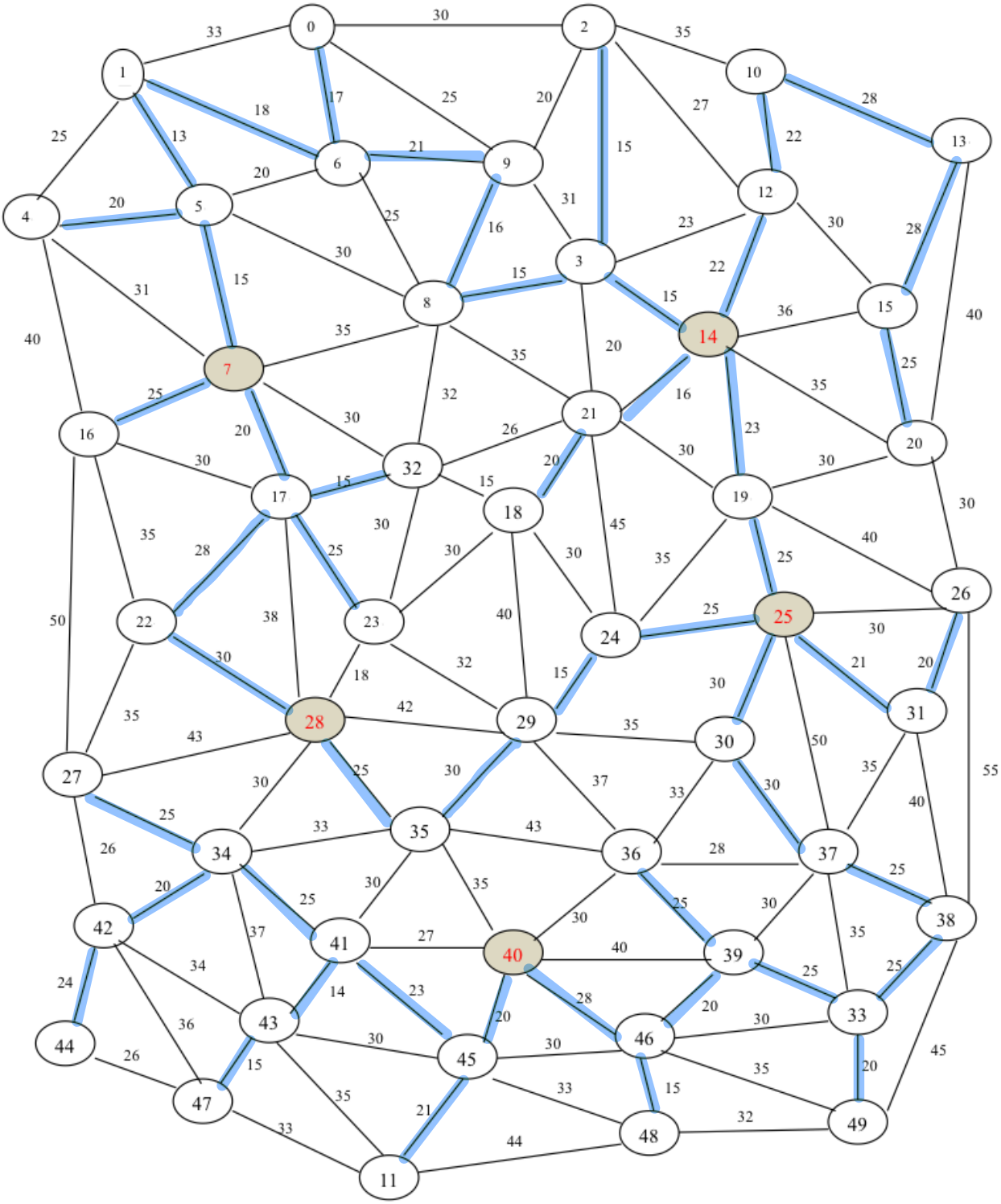
The ABC Utility Company wants to lay cable lines from its field stations to its customers. The locations and the distances between adjacent customers and the field stations are shown in the figure below. The field stations are located at nodes 7, 14, 25, 28, and 40. Remaining nodes show the locations of its customers. The edges show the possible cable routes and the distance between the customers. Customers can be served from any one of these switching stations. Show how company can serve all its customers while minimizing the total cable used.

You do not need exclusive cables from field stations to its customers. The cable lines can be extended from customer to another, but all customers must be served from one of its field stations.

Write a program to determine the edges along which the cables must be laid. Show the final layout of the cables lines. You can draw final cable layout plan by hand. What is the total length of the cable used?

If you could build only one field station that minimizes the total cost of the cable used, which node(s) would you choose for your field station?

The total cost is 1055 (see attached input/output file), and the middle-most station (18) is the optimal one, for there is the least cable in each direction.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