DiGraph and MST
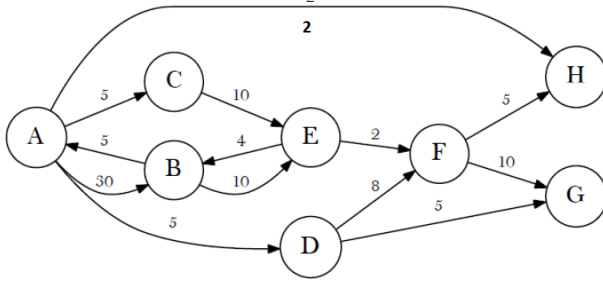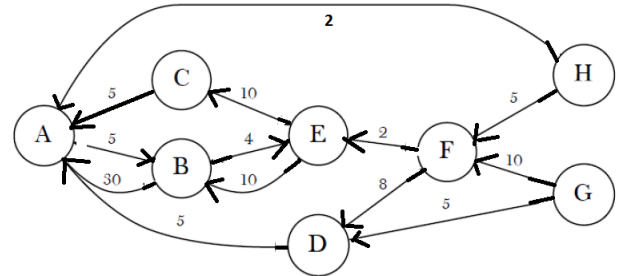
1. **Strong Components**
   Find the strong components of the following digraph.
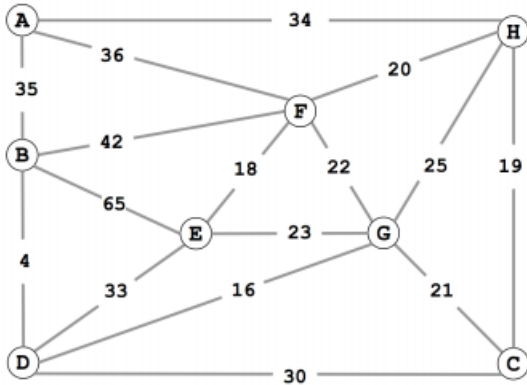

2. **Prims Eager version**
   Find the MST of the following graph using Prim's eager algorithm. Create a table
   with 3 columns named, vertex, edge, weight to show which vertices are in the MST
   and which edge weights are updated during the execution of the Prim's eager version
   of the algorithm.

3. **Graph Interview Questions**

Suppose you are applying for a job at a software company. You are asked to classify if the the following tasks are possible, impossible or unknown. You will need to justify your answers to the interviewer

(a) Given an undirected graph, determine if there is a path of length V-1 with no repeated vertices in worst case time EV

(b) Given a digraph, determine if there is a path of between every pair of vertices in time proportional to E+V

(c) Given an undirected graph, determine if there is a path of between every pair of vertices in time proportional to E+V

(d) Given a digraph, determine if the digraph is a rooted DAG in time proportional to E+V. Rooted DAG means it is a directed acyclic graph, and there is a unique vertex with outdegree equal to 0.

(e) Given an airline route map, find the minimum number of connections from a given city to every other city in linear time.

(f) If you have a choice between Kruskals and Prim's algorithm for finding MST's which one would you pick and why?

4. **Graph Questions - Challenging**

(a) Suppose you know the MST of a weighted graph G. A new graph G_0 is formed by adding a new edge v-w of weight c is to graph G. You may assume all edge weights are distinct. Design an algorithm to determine if the MST in G is also an MST in G_0. What is the order of growth of your algorithm?

(b) Design an algorithm to find a vertex whose removal will not disconnect the graph. What is the order of growth of your algorithm?

(c) Design an algorithm to find the shortest cycle in a directed graph? What is the order of growth of your algorithm?