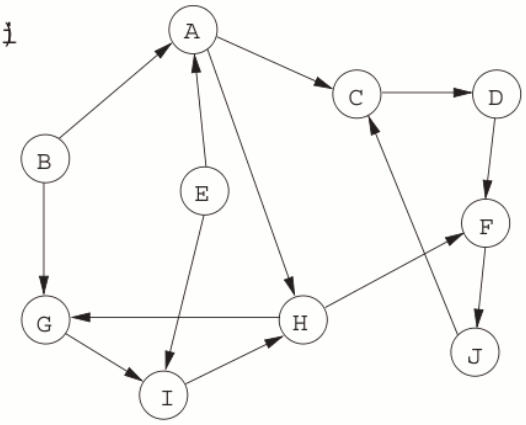
COT5405 - Homework 2

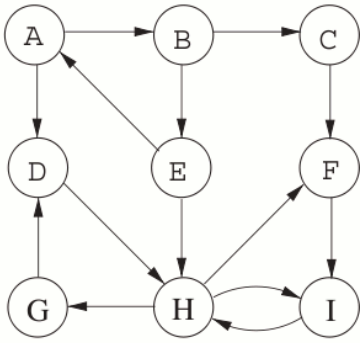
Out date: **09/22/2010** (Wednesday), due date: **09/29/2010** (Wednesday)
15 points each problem.
You need to turn in the solutions for **all four** problems. But we will select **two** problems and **only** grade these two.

3.4. Run the strongly connected components algorithm on the following directed graphs G. When doing DFS on G^R: whenever there is a choice of vertices to explore, always pick the one that is alphabetically first.

(i)



(ii)



In each case answer the following questions.

(a) In what order are the strongly connected components (SCCs) found?
(b) Which are source SCCs and which are sink SCCs?
(c) Draw the "metagraph" (each meta-node is an SCC of G).
(d) What is the minimum number of edges you must add to this graph to make it strongly connected?

(i.a) _____

_____

(i.b) Source SCCs: _____

Sink SCCs: _____

(i.c) Metagraph:

(i.d) _____

(ii.a)

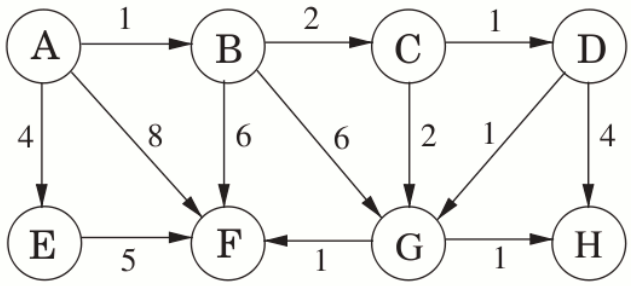
(ii.b) Source SCCs: _____

Sink SCCs: _____

(ii.c) Metagraph:

(ii.d) _____

4.1. Suppose Dijkstra's algorithm is run on the following graph, starting at node *A*.



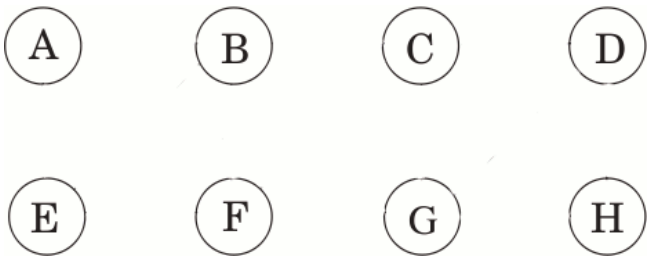
(a) Draw a table showing the intermediate distance values of all the nodes at each iteration of the algorithm.

(b) Show the final shortest-path tree.

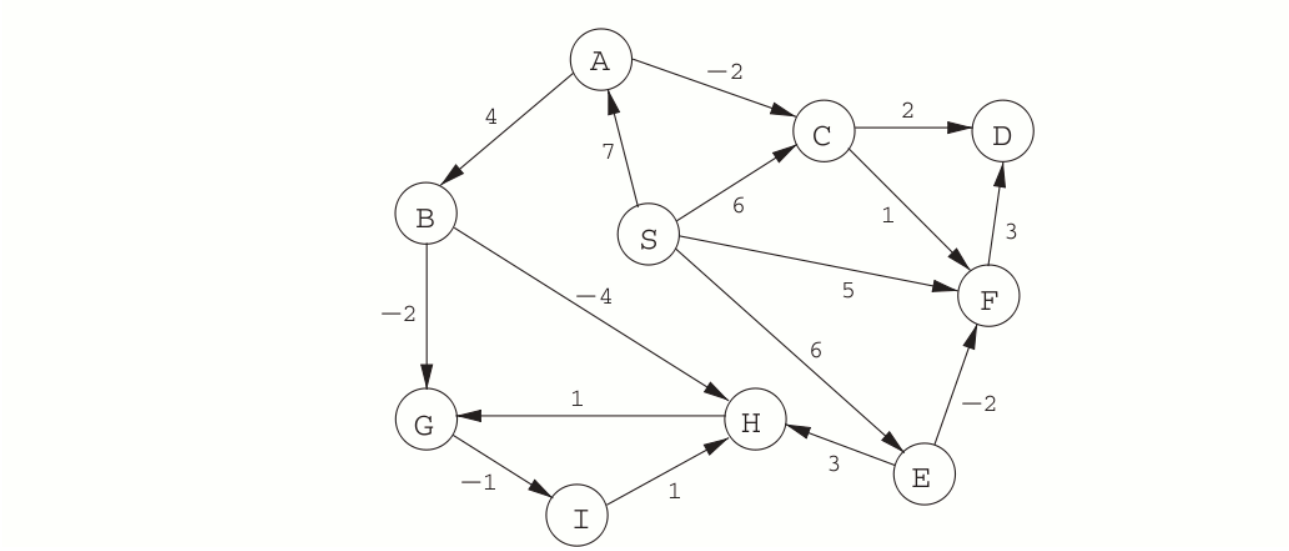
(a)

Node	Iteration							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
A								
B								
C								
D								
E								
F								
G								
H								

(b)



4.2. Just like the previous problem, but this time with the Bellman-Ford algorithm.

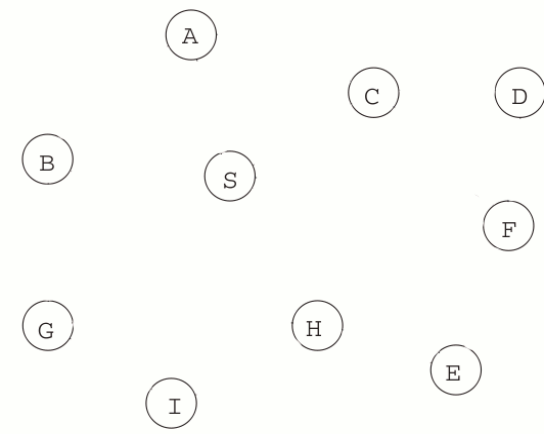


Start at node S. Update the edges in the following order: S->A, S->C, S->E, S->F and the remaining edges in lexicographic order. For example, E->F comes before E->H and C->F comes before F->D.

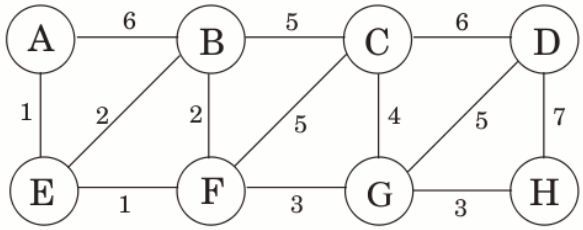
(a)

Node	Iteration						
	0	1	2	3	4	5	6
S							
A							
B							
C							
D							
E							
F							
G							
H							
I							

(b)



5.1. Consider the following graph.



(a) What is the cost of its minimum spanning tree?

(b) How many minimum spanning trees does it have?

(c) Suppose Kruskal's algorithm is run on this graph. In what order are the edges added to the MST? For each edge in this sequence, give a cut that justifies its addition.

(a) _____

(b) _____

(c)

No	Edge included	Cut	
1			
2			
3			
4			
5			
6			
7			