Assignment 6

**Problem 1 (10 points).** Run DFS on the following graph beginning at node G and show the sequence of nodes generated by the search. When you have two or more choices as the next node to visit, choose them in the alphabetical order.

A

B

C

D

E

F

G

After completing the DFS, classify each edge as a *tree edge,* a *forward edge,* a *back edge,* or a *cross edge*.

Answer:

DFS path:

G => E => B => A. Backtrack to B;

B => C => F. Backtrack to F => E

E => D. Finished.

Tree Edge: G => E, E => B, B => A, B => C, C => F, E => D

Forward Edge: E => F, G => F

Back Edge: D => G, C => E

Cross Edge: E => D

**Problem 2 (10 points).** Run BFS on the following graph beginning at node I and show the sequence of nodes generated by the search. When you have two or more choices as the next node to visit, choose them in the alphabetical order.

A

B

D

C

E

F

G

H

I

Answer:

BFS path:

I => F, I => H;

F => E, H => G;

E => B, E => D, G => C;

B => A

**Problem 3 (10 points).** Run Dijkstra’s algorithm on the following graph beginning at node

S.

e

c

d

b

a

2

9

3

16

5

6

5

0

12

4

6

S

∞

∞

∞

∞

∞

**Problem 3-(1)**. After each iteration, show the D values of all nodes (initial D values are shown above each node in red).

Answer:

Values at each node for each iteration:

1st Iteration: edge (s, a), (s, b), (s, c) are relaxed => D[a] = 16, D[b] = 5, D[c] = 12

2nd Iteration: edge(b, a), (b, c), (b, d) are relaxed => D[a] = 8, D[c] = 10, D[d] = 9

3rd Iteration: edge(c, e), (c, d) are relaxed => D[e] = 12, D[d] = 9

4th Iteration edge(d, a) is relaxed => D[a] = 8

**Problem 3-(2)**. Show the shortest path from S to every other node generated by the algorithm

Answer:

S – a: 8

S – b: 5

S – c: 10

S – d: 9

S – e: 12

**Problem 4 (10 points).** Run the Prim-Jarnik algorithm on the following graph beginning at node *a*.

a

b

c

d

e

f

g

15

6

19

12

5

9

17

8

10

20

4

7

**Problem 4-(1)**. Show the sequence of nodes in the order they are brought into the “cloud.”

Answer:

Sequence of nodes: a, c, b, d, g, f, e

**Problem 4-(2)**. Show the minimum spanning tree T, generated by the algorithm, as a set of edges.

Answer:

(a, c), (c, b), (b, d), (d, g), (d, f), (f, e)