

CS 32

Long Exam 2

October 14, 2014

General Instructions

- Answer the items completely. Show your solutions/justifications when asked.
- Write as legibly as possible. Illegible or unreadable answers and solutions may not merit any points.
- Refrain from making unnecessary motions and sounds during the exam. Any suspicious behavior will be dealt with accordingly.
- Direct all questions to the proctor.
- If you need to go to the CR, hand your questionnaire, answer sheet, and scratch paper to the proctor before heading out. Only one person at any given time is allowed to go out.
- Once you're done with the exam (one way or the other), place your scratch papers and the questionnaire inside your blue book.

Questions

Consider the following cost adjacency matrix:

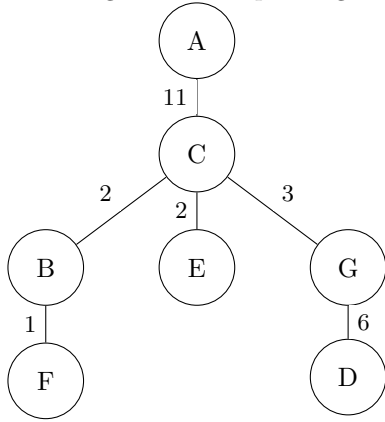
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>
<i>A</i>	0	12	11	∞	∞	∞	∞
<i>B</i>	12	0	2	10	8	1	∞
<i>C</i>	11	2	0	∞	2	4	3
<i>D</i>	∞	10	∞	0	∞	∞	6
<i>E</i>	∞	8	2	∞	0	5	∞
<i>F</i>	∞	1	4	∞	5	0	∞
<i>G</i>	∞	∞	3	6	∞	∞	0

1. Using *Kruskal's algorithm*, construct and draw the corresponding minimum spanning tree for the graph above. Show the status of the computation at each step, *even those that involve rejected candidates for inclusion*.

ANSWER:

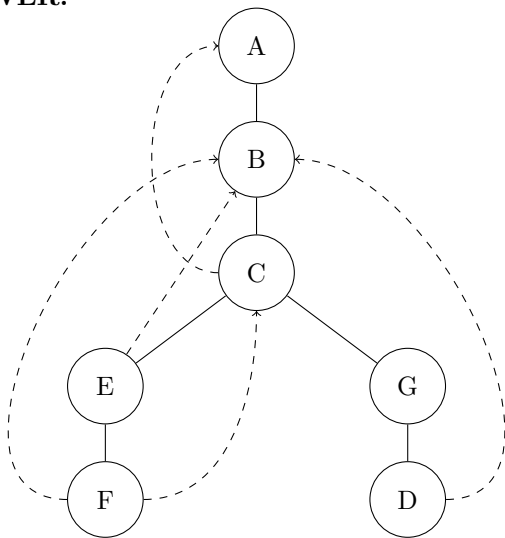
- (a) Choose (B,F) [cost = 1]
- (b) Choose (B,C) (or (C,E)) [cost = 2]
- (c) Choose (C,E) (or (B,C)) [cost = 2]
- (d) Choose (C,G) [cost = 3]
- (e) Choose (C,F) [cost = 4] but reject afterwards as it forms a cycle
- (f) Choose (E,F) [cost = 5] but reject afterwards as it forms a cycle
- (g) Choose (D,G) [cost = 6]
- (h) Choose (B,E) [cost = 8] but reject afterwards as it forms a cycle
- (i) Choose (B,D) [cost = 10] but reject afterwards as it forms a cycle
- (j) Choose (A,C) [cost = 11]

Resulting minimum spanning tree is as follows:



2. Construct the *depth first search* forest from the given graph. Use vertex A as the starting point of the search and at each step of the traversal, prioritize the vertex according to the alphabetical order of the labels. Hence, the arrangement of the children of a node (if any) should be in alphabetical order from left to right.

ANSWER:

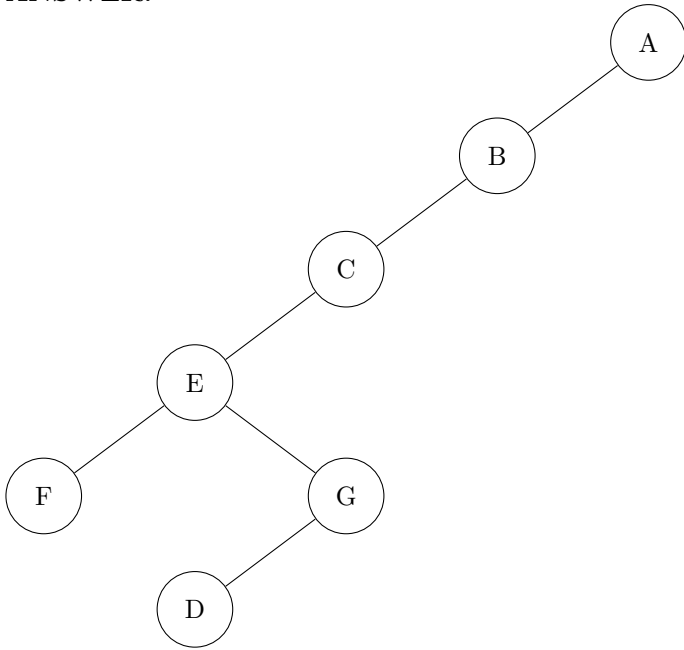


3. Assume that the resulting forest from the previous item is an ordered tree. Give the sequence of vertex labels generated when performing *postorder* traversal on the constructed forest.

ANSWER: F E D G C B A

4. Generate the corresponding binary tree from the depth-first search forest constructed.

ANSWER:

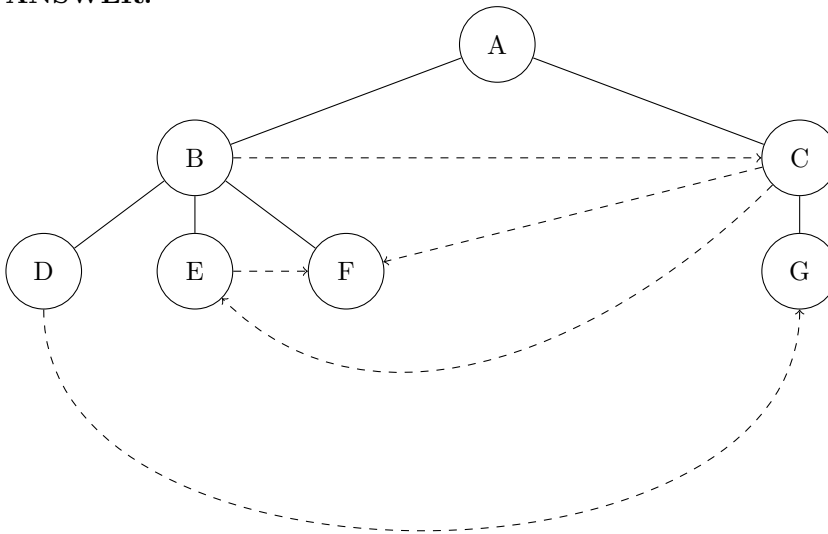


5. Give the sequence of vertex labels generated when performing *inorder* traversal on the corresponding binary tree.

ANSWER: F E D G C B A

6. Construct the *breadth first search* forest from the given graph. Use vertex A as the starting point of the search and at each step of the traversal, prioritize the vertex according to the alphabetical order of the labels. Hence, the arrangement of the children of a node (if any) should be in alphabetical order from left to right.

ANSWER:

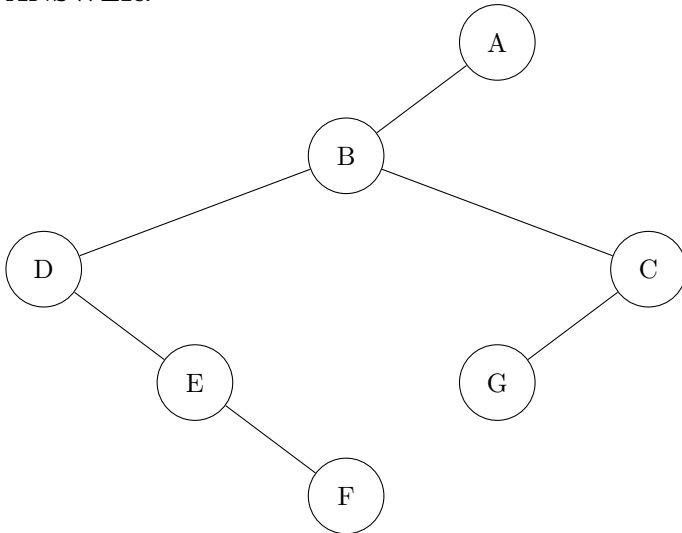


7. Assume that the resulting forest from the previous item is an ordered tree. Give the sequence of vertex labels generated when performing *preorder* traversal on the constructed forest.

ANSWER: A B D E F C G

8. Generate the corresponding binary tree from the breadth-first search forest constructed.

ANSWER:



9. Give the sequence of vertex labels generated when performing *postorder* traversal on the corresponding binary tree.

ANSWER: F E D G C B A

10. Using *Prim's algorithm*, construct and draw the corresponding minimum spanning tree for the graph above. Use vertex D as starting point of the procedure. Show the status of the computation at each step.

ANSWER:

- (a) Choose D [initial step]
- (b) Choose G [edge (D,G), cost = 6]
- (c) Choose C [edge (C,G), cost = 3]
- (d) At this point, two scenarios are possible:
 - Scenario 1
 - i. Choose B [edge (B,C), cost = 2]
 - ii. Choose F [edge (B,F), cost = 1]
 - iii. Choose E [edge (C,E), cost = 2]
 - Scenario 2
 - i. Choose E [edge (C,E), cost = 2]
 - ii. Choose B [edge (B,C), cost = 2]
 - iii. Choose F [edge (B,F), cost = 1]
- (e) Choose A [edge (A,C), cost = 11]

Resulting MST is the same as that shown in Item 1.

Scoring Mechanics

1. For Items 1 and 10: the **computation steps are given priority**, where **each step is considered a feature** (as referred to in the next bullet points). **The resulting MST is considered just one feature.**
2. For Items 1, 2, 4, 6, 8: **0.1 point deduction** is given for each erroneous feature.
3. For Items 3, 5, 7, 9, 10: **0.2 point deduction** is given for each erroneous feature.