Boğaziçi University, Dept. of Computer Engineering

CMPE 250, DATA STRUCTURES AND ALGORITHMS

Spring 2012, Midterm 1

Name: _____

Student ID: _____

Signature: _____

- Please print your name and student ID number and write your signature to indicate that you accept the University honour code.

- During this examination, you may not use any notes or books.

- Read each question carefully and **WRITE CLEARLY**. Unreadable answers will not get any credit.

- For each question you do not know the answer and leave blank, you can get %10 of the points, if you write only "I don't know the answer but I promise to think about this question and learn its solution".

- There are **5** questions. Point values are given in parentheses.

- You have **90 minutes** to do all the problems.

Q	1	2	3	4	5	Total
Score						
Max	20	20	20	20	20	100

1. Run Dijkstra's algorithm on the weighted digraph below, starting at vertex A.
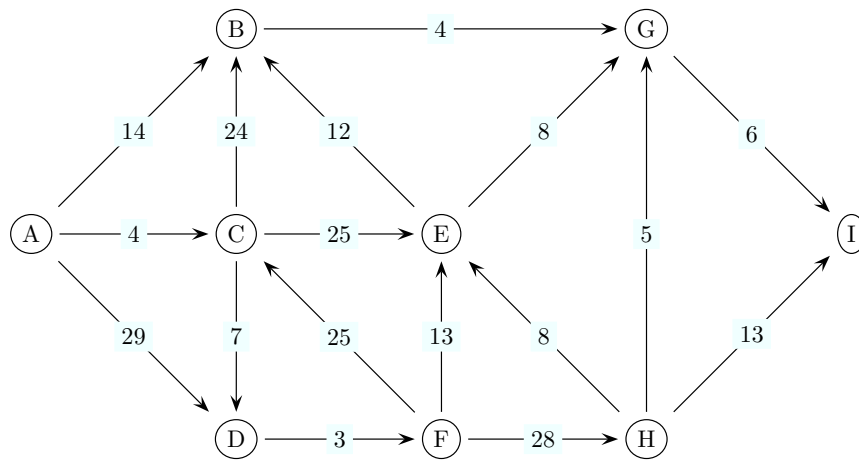
(a) List the vertices in the order in which the vertices are dequeued (for the first time) from the priority queue and give the length of the shortest path from A.

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vertex:   A C ___ ___ ___ ___ ___ ___ ___
distance: 0 4 ___ ___ ___ ___ ___ ___ ___
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(b) Draw the edges in the shortest path tree with thick lines in the figure above.

(20 points)

2. Show the result of inserting $10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, 2$ into a initially empty binary heap (one at a time). *(20 points)*

3. (a) State the formula to find the positions of the parent and children of an element at position j in a D-heap, where this heap is stored as an array.

   [Hint: Remember the layout for a heap that leaves the first array positions empty if necessary.]

   (b) Suppose now, that the same D-heap is represented by using explicit links with node pointers. Give an algorithm to find the tree node that is at implicit position i.

   (20 points)

4. Minimum spanning tree. For parts (a), and (b) consider the following weighted graph with 9 vertices and 19 edges. Note that the edge weights are distinct integers between 1 and 19.
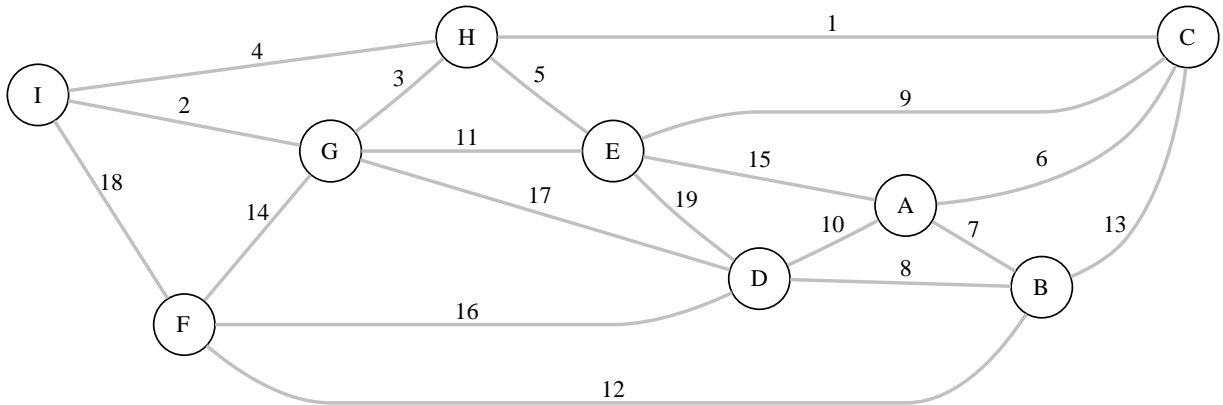
(a) Complete the sequence of edges in the MST in the order that Kruskal's algorithm includes them.

1 _2_ _3_ _5_ _6_ _7_ _8_ _12_

(b) Complete the sequence of edges in the MST in the order that Prims's algorithm includes them.

6 _1_ _3_ _2_ _5_ _7_ _8_ _12_

(20 points)