

CS 324 Fall 2005

Name: _____

Test 2

Talking to other students and the use of notes, books, or electronic devices are not allowed and are considered cheating. There is a total of 85 points plus 25 points of extra credit, but one cannot get more than 85 points.

1. Define the following terms (10 points):

a) Tree

b) Binary Tree

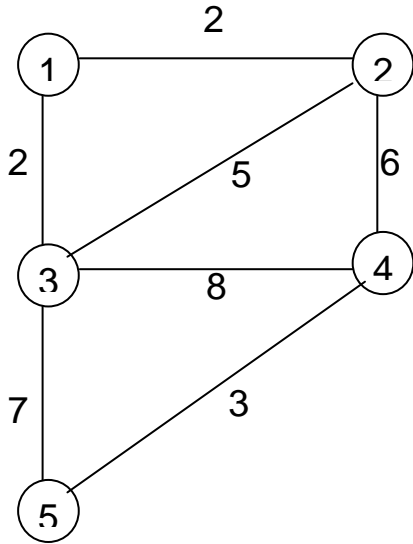
c) Graph

d) Barometer

e) Heterogeneous recurrence

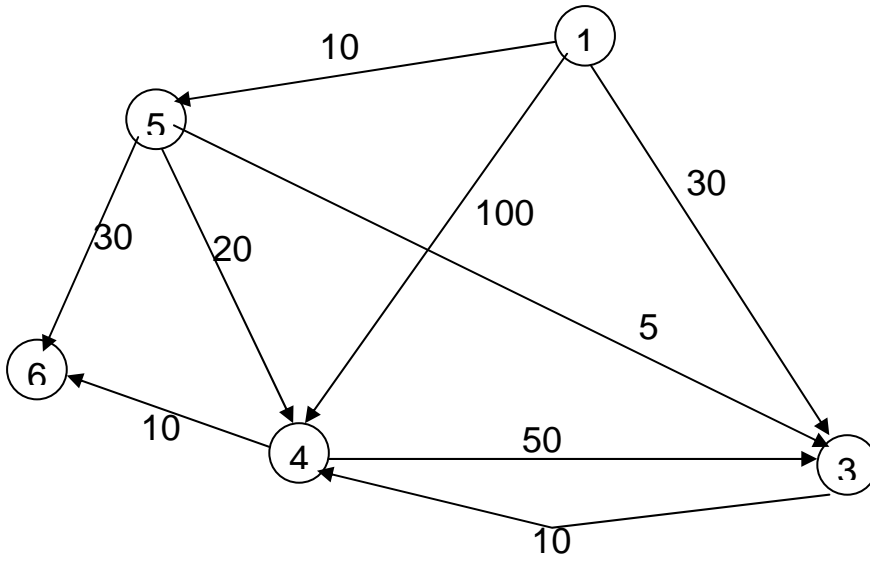
2. Minimum Spanning Tree (15 points)

Using Kruskal's Algorithm, find a minimum spanning tree for the following graph. For each step, list the edge considered and the connected partitions. List all the edges that belong to the tree you found.



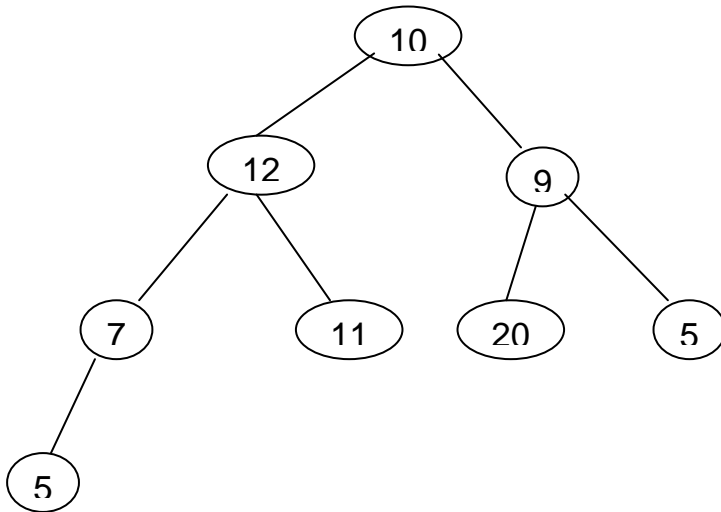
3. Shortest Paths (25 points)

Using Dijkstra's Algorithm, determine the shortest paths from node 1 to all other nodes in the following graph. For each step, show the current distance from node 1 to each other node, and the set of candidates.



5. Heaps (20 points)

- a) Give a precise definition of “heap”.
- b) Using as few sift() and percolate() operations as possible, turn the tree below into a heap. List each operation that you perform and draw the resulting tree.
- c) Represent the heap you created as an array.
- d) What is the exact depth of a heap with 16 elements?
- e) What is the exact depth of a heap with n elements?



6. Union-Find Structures (25 points extra credit)

- a) What is the runtime of `find()` and `union()` operations on a Union-Find data structure?
- b) The following is an array representing a Union-Find data structure. Give the set of sets represented by this data structure using `{}`-notation.

index	1	2	3	4	5	6	7	8	9	10
value	1	2	3	2	5	4	7	7	4	2

- c) Can the following set of sets be represented in a Union-Find data structure? Justify your answer.

{ {3, 56, 78}, {5, 15, 16}, {2, 56, 60} }

- d) What determines how much space is needed for a Union-Find structure? Justify your answer.
- e) Is it possible to store strings in a Union-Find structure? Justify your answer.