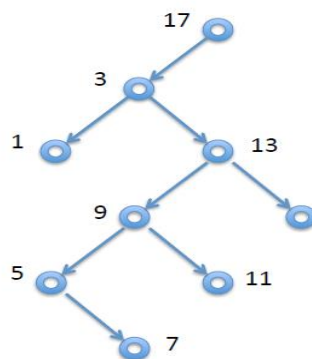


Algorithm Final Exam.

19th, Dec.

1. (10 pts) For each of the following statements, indicate whether TRUE or FALSE and justify your answer.
 - a) Any problem that can be solved with a greedy algorithm can also be solved with dynamic programming.
 - b) NP stands for Not Polynomial.
 - c) Prim's algorithm is a greedy algorithm but Kruskal's algorithm is not.
 - d) Linear probing is equivalent to double hashing if a secondary hash function of $h_2(k) = 1$.
2. (10 pts) Short answer.
 - a) Explain how double hashing is better than hashing with linear probing.
 - b) What kind of data structure does Prim's algorithm use to solve an MST problem?
3. (10 pts) Given an initially empty hash table with size 11 and hash function $H(x) = x \bmod 11$. Keys 0, 1, 8, 9 are already in the table. Insert keys 52, 44, 56, 53, 61, 64 (in this order).
 - a) What is hash table with open addressing (linear probing)?
 - b) What is hash table with open addressing (quadratic probing)?
4. (10 pts) Illustrate the behavior of deletion by removing the element with key 3 from the following tree.



5. (10 pts) Write algorithm in pseudocode to find the successor of node x.
(definition: $\text{successor}(x) = y$, such that $\text{key}[y]$ is the smallest key $> \text{key}[x]$)

6. (10 pts) a) What is the advantage of B-tree over BST or AVL tree?
 b) Suppose a disk block stores 8192 bytes and the basic key size is 32 bytes. Assuming that pointers use 4 bytes, what is the correct choice of M for a B-tree?
7. (10 pts) Several coins are placed in cells of an $n \times m$ board. A robot, located in the upper left cell of the board, needs to collect as many of the coins as possible and bring them to the bottom right cell. On each step, the robot can move either one cell to the right or one cell down from its current location. Design an algorithm to find the maximum number of coins the robot can collect and a path it needs to follow to do this. (*coin collecting problem by robot*)
8. (20 pts) a) For the character frequency array shown below, construct the Huffman coding tree and produce the Huffman code for each character in the frequency array.

Letter	a	b	c	d	e	f
Frequency	10	15	8	3	7	4

- b) How many bits does Huffman code save when compared to the fixed length code (three bits/letter)?
9. (10 pts) Describe an algorithm to find a maximum spanning tree (that is, the spanning tree of largest total weight) of a given graph.