Please use C++ (or Java) for all programming problems.

1. **(10 %)** Write a recursive function isPrime that will return a Boolean value true if the given number is a prime number. Otherwise, it will return false.

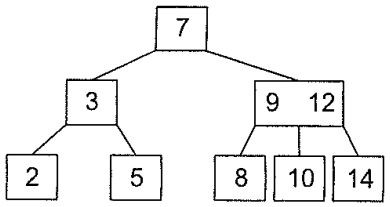
2. **(10 %)** Write a function called removeNegativeNodes that traverses a singly linked list and deletes all nodes whose keys are negative.

3. **(10 %)** A binary tree has eight nodes. The inorder and postorder traversals of the tree are given below. Please draw the tree.
   Inorder: NTUABHSG
   Postorder: NUTHGSBA

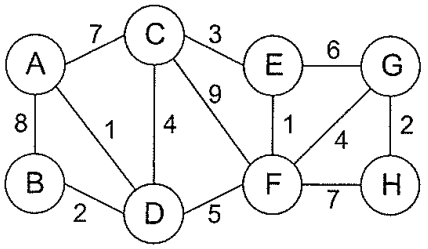
4. **(10 %)** A binary search tree is a special instance of a graph. Describe (no code) an algorithm that takes a binary search tree as input and produces an adjacency list, which represents it as an undirected graph.

5. **(10 %)** Given that both x and y are positive variables that can grow arbitrarily large, prove that $\max\{x, y\} \in \Theta(x + y)$.

6. **(10 %)** What does the 2-3-4 tree on the right look like after remove(2)?



7. **(15 %)** For the graph as shown:
   (a) (8 %) Give the adjacency matrix representation.
   (b) (7 %) Draw the minimum spanning tree.



8. **(15 %)** Sorting.
   (a) (5 %) Apply mergesort and trace it on arrays A = [1 6 25 30] and B = [3 14 28 32 36].
   (b) (10 %) Trace the heapsort as it sorts the following array into ascending order:
   [9 12 4 8 3 11 6 15].

9. **(10 %)** For the inputs {4, 11, 17, 14, 23, 8, 31} and a hash function $h(x) = x \mod 7$, show the linear probing hash table of size 7.

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