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Question 1 10 points

(a) [3 points] What is the maximum height of a red-black tree with n nodes?

Maximum height of a red-black tree with n nodes is 2* log(**n**+1).

(b) [3 points] Which of these has more space complexity: AVL trees or red-black trees? Give a 1-line reason for your choice.

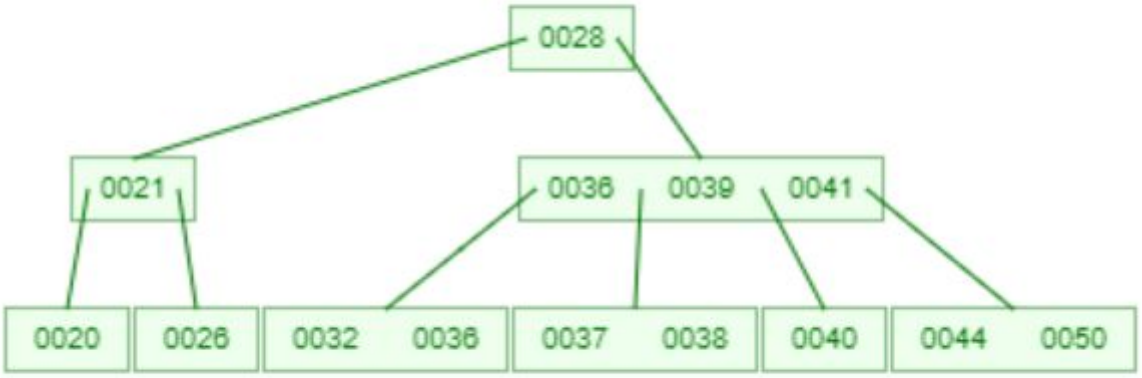
AVL trees require more space complexity because each node contains additional data about balance factor. Red-black trees also contain additiıonal information but its less than AVL-trees.

(c) [4 points] When finding the minimum spanning tree of a graph, what is the stopping criteria in Prim's algorithm?

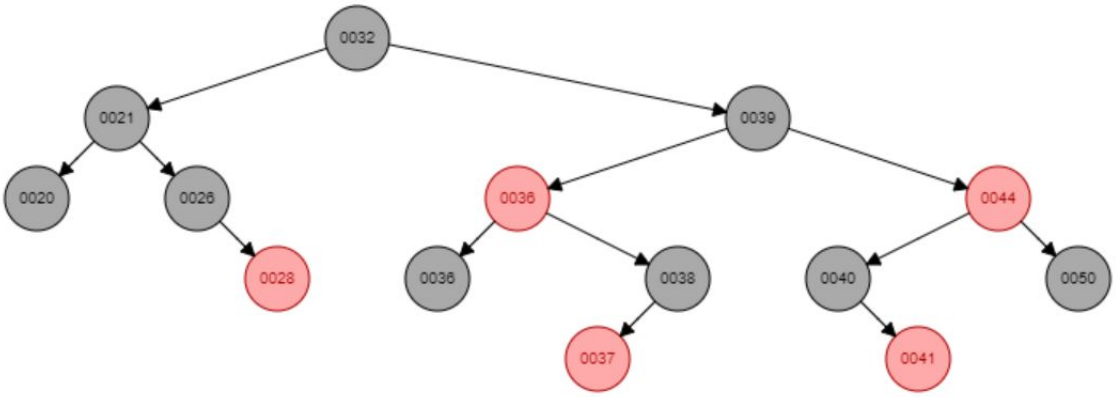
When there are no unvisited vertices left, Prim’s algorithm stops.

Question 2 20 points

(a) [5 points] Insert items with the following key values in a 2-3-4 tree: [36, 39, 40, 32, 20, 36, 21, 26, 28, 38, 50, 37, 44, 41]. Show only the final tree.



(b) [5 points] Convert the previous 2-3-4 tree to a red-black-tree.



(d) [5 points] A city map of Romania is given below. Find the path and the length of the path from Arad to Bucharest using Breadth First Search. Make sure to show your work

Arad, zerind, Oradea,Sibiu, Rimicu Vilcea,Pitesti, Bucharest

length is 575