

- 1) Show the red-black trees that result after successively inserting the keys 41, 38, 31, 12, 19, 8 into an initially empty red-black tree. [CLRS 13.3-2]

**10 points**

- 2) Rewrite the procedure DFS, using a stack to eliminate recursion. [CLRS 22.3-7]

**15 points**

- 3) Design an efficient algorithm that gets a graph  $G(V,E)$  and returns “yes” if it is possible to have an Eulerian tour in  $G$ . Otherwise it returns “no”.

**15 points**

- 4) Assume that in each node of a graph an integer value has been stored. Design an efficient algorithm that given a graph  $G(V,E)$  and value  $X$  returns true if  $X$  is in  $G$ . Otherwise returns false.

**10 points**