

CSC 355. Discrete Structures & Basic Algorithms
Module 3. Introduction to Data Structures

Instructions: Solve the following questions.

Question 1. Written Response.

- (a) Write an algorithm that takes a linked list of size N elements and splits it into two linked lists where the first list contains all the elements that are less than or equal to the first element in the list and the second list contains all the elements that are greater than the first element in the list.
- (b) Show that your algorithm works by running it on example list given below.

Example:

Input: $L = 3 \rightarrow 4 \rightarrow 1 \rightarrow 0 \rightarrow 2 \rightarrow 9$

Output: $L1 = 3 \rightarrow 1 \rightarrow 0 \rightarrow 2$ and $L2 = 4 \rightarrow 9$

Question 2. Written Response.

Let A be an array of size N that is made up of two separate subarrays that are already sorted in increasing order. Let i be the index where the first sorted subarray ends. Write an algorithm that runs in $O(N)$ time and that merges the two sorted subarrays into a single sorted array.

Example:

Input: $[0, 2, 5, 6, 2, 6, 6, 7, 8, 9], 3$

Output: $[0, 2, 2, 5, 6, 6, 6, 7, 8, 9]$

Question 3. Fill in the blank.

1. Identify the main elements in the Binary Tree described below (10 points):

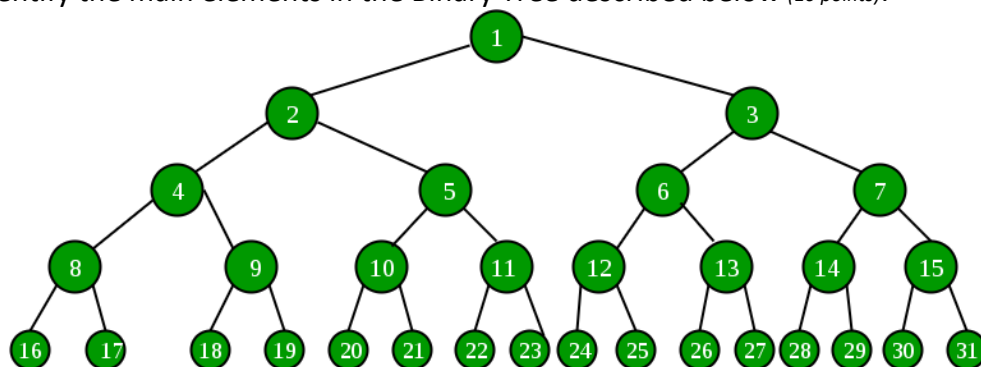


Figure 1. Binary Tree

- a) Size of the tree: _____
- b) Root node: _____
- c) List the internal nodes: _____
- d) Identify the child node(s) of node 8 and node 15: _____
- e) # Leaf nodes and list them: _____

Question 4. Written Response.

A palindrome is a string that reads the same forwards as backwards. Using only a fixed number of stacks and queues, the stack and queue functions, and a fixed number of int and char variables, write an algorithm to determine if a string is a palindrome. Assume that the string is read from standard input one character at a time. The algorithm should output true or false as appropriate.

Submission Instructions

You must upload your homework in a **pdf** file in the designated area in D2L.

Grading Points

Total Score: 25 points

**Each question has a value of 6.25 points*