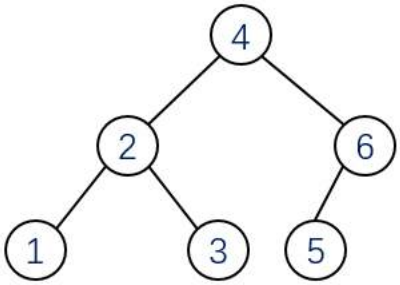
CS 101 Fall 2020 - Quiz 5-B

10/22/2020 - 20 Minutes **Name:** **ID number:**

Problem 1(4pts): Use a stack to implement **postorder** DFS, and show what are inside the stack step by step. Note that you should push the items onto stack according to **least first** when handling the cases where there are 2 children of some node. Then write the sequence of your **postorder** DFS.

(Don't worry if you can't write the right answer at one chance. You are provided with three stacks below and you can use them one by one until you think your answer is correct.)



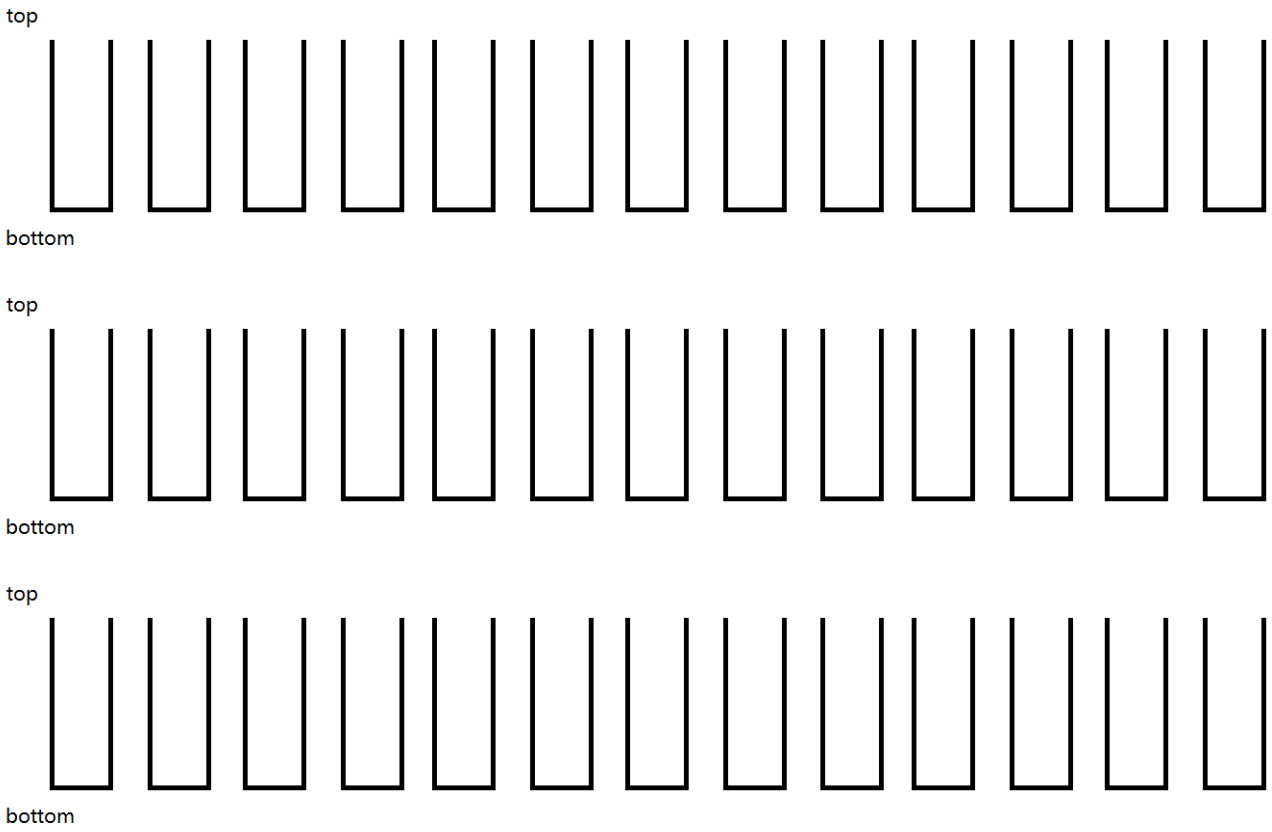


FIGURE 1.

Sequence:_____

Problem 2 Single Choice(2×2pts): The following questions are single choice questions, each question has **only one** correct answer. Select the correct answer.

Note: You should write those answers in the box below.

Question 1	Question 2

2.1: What is time complexity of running DFS which contains n nodes using a stack?

(a) $O(n)$

(b) $O(nlogn)$

(c) $O(logn)$

(d) $O(n^2)$

2.2: Given the recurrence $f(n) = pf(n/q) + 1$, how many sub-problems will a divide-and-conquer algorithm divide the original problem into, and what will be the size of those sub-problems?

(a) p sub-problems, each of size q

(b) p sub-problems, each of size n/q

(c) q sub-problems, each of size p

(d) q sub-problems, each of size n/p

Problem 3(2pts): Let $T(n)$ be the function defined by $T(1) = 1$, $T(n) = 2T(\lfloor \frac{n}{2} \rfloor) + \sqrt{n}$ for $n \geq 2$. Which of the following statements is true? Write your answer directly.

Your answer : _____

Problem 3(5pts): There are n students and each student i has 2 scores x_i, y_i. Students i, j are friends if and only if $x_i < x_j$ and $y_i > y_j$. How many pairs of friends are there? Design an efficient algorithm. For comparison, our algorithm runs in $O(n \log n)$ time. (Hint: extend merge sort.)