CS2210a Data Structures and Algorithms
Assignment 3
Due date: October 26
Total of 20 Marks

You need to print and fill out an assignment submission form. The form can be downloaded from
http://www.csd.uwo.ca/courses/CS2210a/submForm.pdf.

You must staple the submission form at the front of your assignment, so the submission form is the cover page. Drop your assignment in the CS2210 locker (located on the third floor of the Middlesex College Building, beside room MC300) by 11:59 pm on October 26.

1. (2 marks) Consider a hash table of size $M = 7$ where we are going to store a set of integer key values. The hash function is $h(k) = k \bmod 7$. Draw the table that results after inserting, in the given order, the following values: 19, 1, 12, 26, 11. Assume that collisions are handled by separate chaining.

2. (2 marks) Show the result of the previous exercise, assuming collisions are handled by linear probing.

3. (2 marks) Repeat exercise (1) assuming collisions are handled by double hashing, using a secondary hash function $h'(k) = 5 - (k \bmod 5)$.

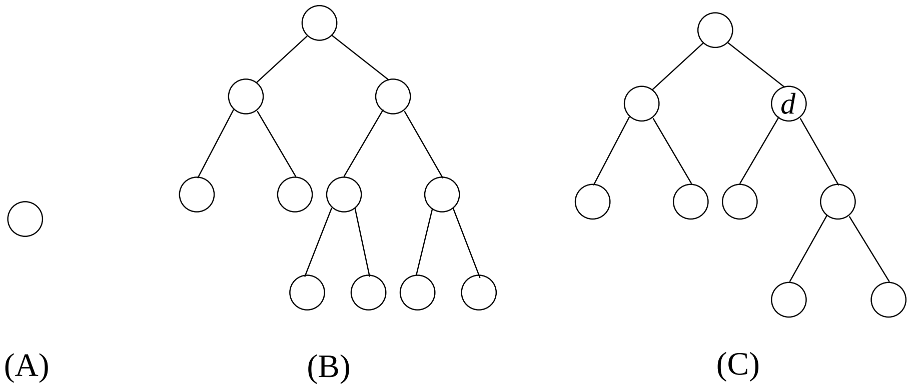
4. (4 marks) Solve the following recurrence equation by repeated substitution and give the order ("big Oh") of $f(n)$. You must show how you solved the equation.

   $f(1) = 1$

   $f(n) = f(n/2) + 2$

   You might assume that n is a power of 2, i.e. $n = 2^k$ for some integer $k > 0$.

5. - (6 marks) A proper binary tree is *regular* if either both children of an internal node are leaves or both of them are internal nodes. For example, in the following figure, trees (A) and (B) are *regular*, but tree (C) is not as node d has a child that is a leaf and the other one is an internal node.



   Write in pseudocode an algorithm that receives as input the root r of a proper binary tree and it outputs `true` if the tree rooted at r is *regular*, and false otherwise.

   - (4 marks) Compute the worst case time complexity of your algorithm as a function of the total number of nodes in the tree. You must give the order of the time complexity of the algorithm, and you must explain how you computed it.