CMPT 307 Homework 4

October 16, 2019

This homework is not to be handed in.

Problems are relevant for Quiz 2.

1. Problems from the text (Chapter 3): Most of the exercise problems in Chapter 3 in the text are interesting and should be solved. The problems that are designated as practice problems are: 2, 3, 4, 5, 7, 8, 11, 12, 13, 14, 16, 18, 22, 24, 26, 27, 29.

2. Suppose that we are given a set of depth first intervals of the nodes of a graph G as follows:
   $v[1] : [5, 8]$,
   $v[2] : [14, 15]$,
   $v[3] : [9, 10]$,
   $v[4] : [2, 3]$,
   $v[5] : [4, 11]$,
   $v[6] : [1, 12]$,
   $v[7] : [6, 7]$,
   $v[8] : [13, 16]$

   Answer the following queries for graph G.

   (a) What are the descendant and ancestor nodes of $v[5]$ in G?

   (b) How many components are there in G?

   (c) Identify a pair of nodes in a connected component of G which are not related (i.e. one is neither descendant nor ancestor of other).

   (d) Construct the depth first tree of G which realizes the dfs intervals as given.

   (e) Just add one edge to G which will guarantee that G is not an acyclic graph.

   (f) Remove one node from G such that the number of connected components remains the same. (Note that G may have many edges which we are not aware of.)

3. An ascending sorted sequence of distinct values is one in which some form of a less than operator is used to order the elements from smallest to largest. For example, the sorted sequence A, B, C, D implies that $A < B$, $B < C$, and $C < D$. In this problem you will be given a set of relations of the form $A < B$ and ask you to determine whether a sorted order has been specified or not.

4. **Pushing Boxes UVA 589** We are interested in checking whether there is a sequence of pushes which will bring the box at the starting place to the target cell. Can you solve this problem by creating a graph first and then apply dfs?

5. **A knight's Journey** Given an $A \times B$ rectangular board and the starting position of the knight, determine whether the knight can visit every square of the board.

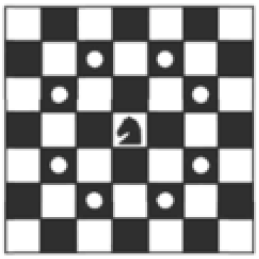

Figure 11.11 Eight possible moves of a knight.

6. **Other interesting UVA problems involving graph traversals**

   - UVA 10067 Playing with wheels
   - UVA 10051 Tower of cubes