Instructor: Dr. Sartaj Sahni
2005

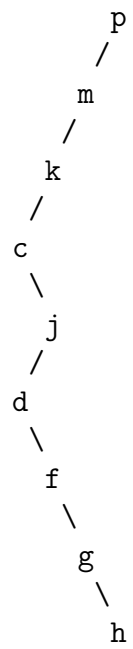
Advanced Data Structures
(NTU AD 711R)
Exam 3

CLOSED BOOK
70 Minutes

Name: _____

NOTE: All answers will be graded on correctness, efficiency, clarity, elegance and other normal criteria that determine quality. The points assigned to each question are provided in parentheses.

1. (50) Consider the following splay tree:



   (a) (25) Perform a search for element h under the assumption this is a *Top-down* splay tree. Show the tree(s) after each step of the splay.

   (b) (25) Do part (a) assuming a *Bottom-up* splay tree.

2. (50) Insert the following keys in the given order into an initially empty instance of *Patricia*. Use the method discussed in the text/class. Show the tree after each insertion.

00010, 00000, 00001, 00100, 11111, 10000

3. (50) You are given two strings S and T of length m and n, respectively.
   Describe how to find the *Longest Common Substring* of S and T using any data structure discussed in the class *and* provide an example.
   Your algorithm should run in linear time with respect to m and n.

4. (50) A min radix priority search tree (RPST) can be defined as a set of pairs [x,y] over [0..63] of integers.
   Construct a min RPST by *inserting* the following pairs in the given order. Show the min RPST following each insertion.

   (9,49), (30,11), (20,1), (60,15), (25,60), (11,37)

   Delete (11,37) from the resulting tree. Show the tree following the deletion.

5. (50) Describe the 2-dimensional range tree data structure. Derive the formula for the preprocessing time P, the space required S, and the query time Q.