

Data Structures: 505 22240 / ESOE 2012

Homework Assignment 2: Hash Tables and Rooted Trees

Due: the week after next in class, 11:10am

Total score: 100

1. Draw the 11-entry hash table that results from using the hash function, $h(i) = (2i + 5) \bmod 11$, to hash the keys 12, 44, 13, 88, 23, 94, 11, 39, 20, 16, and 5, assuming collisions are handled by chaining. (25%)
2. *Linear probing* is a simple collision resolution strategy in open addressing. In this approach, if we try to insert an entry (k, v) into a bucket $A[i]$ that is already occupied (where $i = h(k)$), then we try next at $A[(i+1) \bmod N]$. If $A[(i+1) \bmod N]$ is also occupied, then we try $A[(i+2) \bmod N]$, and so on, until we find an empty bucket that can accept the new entry. For more detail explanation, please refer to pgs. 574~575 of Section 18.4.2 of the textbook. What is the result of Problem 1 if collisions are handled by linear probing? (25%)
3. Based on the definition of “tree height” in the textbook and by using mathematical induction, prove that the maximum number of nodes in a binary tree of height h is $2^h - 1$. (20%) (Chapter 15, Exercise 18)
4. Based on the terminologies defined in lecture, please refer to the tree figure on the next page and answer the following questions: (30%)
 - a. A node is **internal** if it has one or more children. What are the internal nodes? (9%)
 - b. How many descendants does node BIO520 have? (1%) What are they? (5%)
 - c. How many ancestors does node BIO520 have? (1%) What are they? (4%)
 - d. What are the siblings of node JoonesPE? (2%)
 - e. Which nodes are in the subtree rooted at node paulp, except paulp? (4%)
 - f. What is the depth of node perl? (2%)
 - g. What is the height of the tree? (2%)

