

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)
Note: the definition of tree height is the number of nodes on the longest path from the root to a leaf, which is different from our definition in lecture.
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%)

