CPSC 2150 – Algorithms and Data Structure II

Lab8: Hashing

Total - 40 Marks

Learning Outcomes

- Practice on hashing and resolving collisions
- Implementing and programming with C++

Resources

- Chapter 9 of the text book

Description

Exercise 1 – [20 marks] You have a hash table of size m = 11 and two hash functions h1 and h2:

h1(x) = (sum of the values of the first and last letters of x) mod m

h2(x) = ((value of the last letter) mod (m − 1)) +1

where the value of a letter is its position in the alphabet (e.g., value(a)=1, value(b)=2, etc.). Here are some precomputed hash values:

word: *ape bat bird carp dog hare ibex mud koala stork*

h1: 6 0 6 8 0 2 0 6 1 8

h2: 6 1 5 7 8 6 5 5 2 2

A. **[7 marks]** Draw a picture of the resulting hash table after inserting, in order, the following words:

ibex, hare, ape, bat, koala, mud, dog, carp, stork.

B. **[3 marks]** Highlight cells that are looked at when trying to find bird.

Do part A and B for each of the following techniques:

1. Separate chaining with h1 as your hash function.
2. Double hashing with h1 as your first hash function and h2 as your second hash function.

Exercise 2 – Hash worse case: A hash table of size M stores N integer keys. Collisions are handled by chaining and the hash function is h(K) = K mod M.

1. **[8 marks]** What is the worst-case search time? Give an example of a set of keys that achieves the worst-case search time.
2. **[2 marks]** Would you use this hash table for a time-critical application (e.g., air traffic control)?

Exercise 3 – Linear probing with load factor: Demonstrate the insertion of the keys 5,28,19,15,20,33 into a hash table with collisions resolved by linear probing. Assume that the hash table has m slots (*m=7*) and its load factor is 0.70 and the hash function is *h(k) = k mod m*. For rehashing, choose the closest prime number less than twice of current m as the new value of m.

[10 marks] Draw the state of the hash table after every insertion.

SUBMIT to D2L

Submit a zip file named **StudentNumber-Lab8.zip** including **answers.pdf** file by the due date. For example, if your student number is 10023449, the submitted file must be named as **10023449-Lab8.zip**.