CSE373 Worksheet on Hash Tables
05/01/14

1.Finding an element in a hash table containing N elements where separate chaining is used and each bucket points to an AVL tree/ sorted linked list/ unsorted linked list. The table size = N.   Run Time:

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2. (a) Fill in the contents of the hash table below after inserting the items shown. To insert the item k, use the hash function k mod TableSize and resolve collisions with quadratic probing.
Insert: 13, 44, 103, 113, 2

0	1	2	3	4	5	6	7	8	9

(b) We now consider looking up some items that are not in the table after doing the insertions above.
For each, give the list of table locations that are looked at in order before determining that the item is not present. Include all the table locations examined, whether or not they contain an item. Note: these items are only being looked up, not inserted.

i. 57
ii. 42
iii. 11

(c) Give the load factor for the hash table.

7. (a) Under what circumstances can you use perfect hashing?

(b) List what (if anything) is required in order for the following collision resolution methods to be guaranteed of finding a spot in the table to insert a new value (i.e. a value not previously in the table). Assume no rehashing (i.e. table resizing) occurs.

- Separate chaining
- Linear probing
- Quadratic probing

(c) Which collision resolution methods require lazy deletion?

(d) Double hashing is a collision resolution method that avoids the primary and secondary clustering caused by linear and quadratic probing. How does it accomplish this?

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3. Consider a hashtable with separate chaining with N buckets and k items currently in the table.

(a) k/N is the definition of a term used when discussing hashing. What is this term?

(b) Is it necessary that k < N?

(c) What is the average number of items in a bucket?

(d) In the worst-case, how many items could be in a single bucket?

(e) If k > N, is it possible that any buckets are empty?

(f) If we resize the table to a table of size 2N, what is the asymptotic running time in terms of k and N to put all the items in the new table?

5. For each of the following errors when using hashing and hashtables, give the best answer as to what can go wrong. Notes:
- "Not terminate" is often described as "go into an infinite loop."
- The choices are the same in each problem:

i. A lookup operation may not terminate.
ii. A lookup operation may not and a value that is actually in the table.
iii. Both (i) and (ii).
iv. Neither (i) nor (ii).

(a) You are using open addressing with quadratic probing and you allow the table (whose size is a prime number) to become more than half full:

(b) You are using open addressing with quadratic probing and you delete an item by removing it from the table and leaving the bucket it held empty.

(c) You are putting objects of a class you defined into the Java standard library's hashtable. Your class overrides equals but not hashCode.

(d) You write a really bad hash function that causes all objects to initially hash to the same bucket.