Program 5 due 10 pm Friday, May 6th

Homework 9 due 10 pm tomorrow, April 22nd
Homework h10 assigned Monday

Last Time
Graphs
  • topological ordering
  • Dijkstra’s algorithm
Exam 2 returned

Today
Hashing
  • terminology
  • designing a good hash function
  • choosing table size

Next Time
Read: finish Hashing, start Sorting
Hashing
  • expanding a hash table
  • handling collisions
Java Support for Hashing
Tree Map vs. Hash Map
Sorting Intro
Hashing

Goal:

Concept:

hash table

table size (TS)

load factor

key

hash function

hash index
Ideal Hashing

Assume

- store 150 students records
- table is an array of student records
- null is sentinel value meaning element is unused
- key is the student id number, a 5 digit integer

11000, 11001, 11002, ... 11048, 11049, ... 11148, 11149

→ What would be a good hash function to use on the ID number?
  
  int hash(K key) {

  }

Trivial Hash Function:

Perfect Hash Function:

void insert(K key, D data) {
  D lookup(K key) {
  
  void delete(K key) {

The UW uses 10 digit ID numbers: 9012345789 9012345432 9023456789
→ Is a perfect hash function possible for these id numbers?

→ Would the last 3 digits of the ID work as above?

Collision:

Key Issues:
Designing a Hash Function

Good Hash Functions:

1.

2.

3.

4.

Java Hash Function Steps:

1.

2.
Techniques for Generating Hash Codes

Integer Key 90123456789

\[123 \times 11 + 456 \times 121 + 789 \times 1\]

Extraction

Weighting

Folding
Handling String Keys
Handling Double Keys
Choosing the Table Size

Table Size and Collisions

Assume 100 items with random keys in the range 0 – 9999 are being stored in a hashtable. Also assume the hash function is simply %tablesize.

→ How likely would a collision occur if the table had 10000 elements? 1000? 100?

Table Size and Distribution

Assume 50 items are stored in a hashtable. Also assume the hashCode function returns multiples of some value x. For example, if x = 20 then hashCode returns 20, 40, 60, 80, 100, ...

→ How likely would a collision occur if the table had 60 elements? 50? 37?