CS 367 - Introduction to Data Structures  
Monday, July 27, 2015, Lecture 24  

Course website: http://pages.cs.wisc.edu/~cstapleton/367/  
Piazza: https://piazza.com/wisc/summer2015/cs367/  

Instructor  
Cea Stapleton  
cstapleton@cs.wisc.edu ; Use Piazza for course related questions.  

TA  
Haseeb Tariq  
haseeb@cs.wisc.edu ; Use Piazza for course related questions.  

Last Time  
- Hashing (cont’d)  
- Examples of hash functions  
- Non-Integer Keys  
- Advanced Collision Handling  

Today  
- HW6 Due  
- P4 Assigned  
- Hashing (finish)  
- Open addressing (finish)  
- Hashing in Java  
- Sorting  

Next Time  
- Sorting (basic)
Hashing

What problem are we solving?

Idea:

Terminology:
- Key
- Hash table
- Table Size (TS)
- Load Factor (LF)
- Hash function
- Collision
- Ideal hashing
Collision Handling (advanced): Open Addressing

Linear probing

Quadratic probing

Double Hashing
Hashing in Java

hashCode() method:

- All Objects have it
- returns an int
- default is computed from memory address (NOT good!)

Overriding hashCode():
public class CoordinatePair {
    private int x, y;

    public int hashCode() {
        return (x * 31) ^ y;
    }

    public boolean equals(Object o) {
        if (o instanceof CoordinatePair) {
            CoordinatePair other = (CoordinatePair) o;
            return (x == other.x && y == other.y);
        }
        return false;
    }
}
Hashtable<K,V> and HashMap<K,V> in Java

Both implement Map<K,V> interface

What are K, V?

Constructors

Operations

Collision handling
Differences

**TreeMap vs. HashMap**

---

**Sorting**

Problem

---

**Solutions**

Complexity (comparison sorts vs. others)
In-place Sorting