Announcements/Reminders:

Last class:

• Sorting (smarter)

Today:

• Sorting (finish)
  • Radix Sort
  • Stable sorts
  • Sorting in Java

• Graphs

• Week in Review
Radix Sort

Strategy:

Analysis:
Stable Sorts

Madison     WI
New York    NY
Chicago     IL
Detroit     MI
Buffalo     NY
Milwaukee WI
Peoria      IL

Sorted by state:

Chicago     IL  Chicago     IL  Chicago     IL
Peoria      IL  Peoria      IL  Peoria      IL
Detroit     MI  Detroit     MI  Detroit     MI
New York    NY  Buffalo     NY  New York    NY
Buffalo     NY  New York    NY  Buffalo     NY
Madison     WI  Madison     WI  Milwaukee WI
Milwaukee WI  Milwaukee WI  Madison     WI

What's the difference?
Sorting in Java (java.util)

Arrays.sort(array_to_sort):

    String[] names = {"Tim", "Alison", "Nate"};
    Arrays.sort(names);
    System.out.println(Arrays.toString(names));

Collections.sort(List):

Use Comparators to define your own order:

    public interface Comparator<T> {
        int compare(T o1, T o2);
    }

    public class myCmp<myClass> implements Comparator<myClass> { 
        public int compare(myClass o1, myClass o2) {
            ...
        }
    }
Types of Data Structures
(in terms of #predecessors and #successors)

Linear

Hierarchical

Graphical
Graph Terminology

- Nodes
- Edges: Weighted and unweighted
- Directed vs. undirected
- Degree of a node
- Self-edge
- Cyclic vs. acyclic
- Adjacency
- Predecessor, successor
- Path, path length
- Search/Traversal
- Complete graphs
- Directed Acyclic Graphs (DAG)
- Connected: Weakly, Strongly
Implementing Graphs

GraphNode

Graph
Representing Edges

Adjacency Matrix:

**Graph 1**

```
0 1 2 3 4
0 |   |   |   |   |
1 |   |   |   |   |
2 |   |   |   |   |
3 |   |   |   |   |
4 |   |   |   |   |
```

**Graph 2**

```
A B C D E
A |   |   |   |   |
B |   |   |   |   |
C |   |   |   |   |
D |   |   |   |   |
E |   |   |   |   |
```
Representing Edges (cont’d)

Adjacency Lists:

Adjacency list for these graphs:

<table>
<thead>
<tr>
<th>Graph 1</th>
<th>Graph 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>A:</td>
</tr>
<tr>
<td>1:</td>
<td>B:</td>
</tr>
<tr>
<td>2:</td>
<td>C:</td>
</tr>
<tr>
<td>3:</td>
<td>D:</td>
</tr>
<tr>
<td>4:</td>
<td>E:</td>
</tr>
</tbody>
</table>