Maps
Chris Piech
CS106A, Stanford University
Make a keyboard
Where are we?
Where are we?

- Karel the Robot
- Java
- Console Programs
- Graphics Programs
- Text Processing
- **Data Structures**
- GUIs
- Defining our own Variable Types
Collections High Level

List:  ArrayList<\textit{type}>

Array:  \textit{type}[]

Matrix:  \textit{type}[][]
Collections High Level

List:  ArrayList<String>
Array: double[]
Matrix: int[][]
ArrayList

index -> value
Arrays

index -> value
Matrix

(row, col) -> value
Maps can have any type for key

Many examples
HashMap
key ➔ value
1. Make a new HashMap of animal sounds

2. Add elements:
   Put [key = "dog", value = "bark"]
   Put [key="cat", value="meow"]
   Put [key="seal", value="ow ow ow"]

3. Get elements:
   Get [key = "dog"]
Simple Example

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Simple Example

animalSoundMap

Values:  "bark"  "meow"

Keys:  "dog"  "cat"

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Keys:
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- "seal"
- "cat"

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3. Get elements:
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HashMap<String, String> animalSoundMap = new HashMap<String, String>();
My First Map

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HashMap<String, String> animalSoundMap =
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animalSoundMap.put("dog", "bark");
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3. Get elements:
   Get [key = “dog”]
// 1. Make a new map
HashMap<String, String> animalSoundMap = new HashMap<String, String>();

// 2. Put things into the map
animalSoundMap.put("dog", "woof");
animalSoundMap.put("cat", "meow");
animalSoundMap.put("seal", "ow ow ow");

// 3. Get things out of the map
animalSoundMap.get("dog"); // "woof"
My First Map

animalSoundMap

Values:
- "bark"
- "ow ow ow"
- "meow"

Keys:
- "dog"
- "seal"
- "cat"

// 1. Make a new map
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animalSoundMap.put("cat", "meow");
animalSoundMap.put("seal", "ow ow ow");

// 3. Get things out of the map
animalSoundMap.get("dog"); // "woof"
animalSoundMap.get("fox"); // ?
brothers Vegard and Bård Ylvisåker

Circa 2013
But there’s one sound

My First Map

animalSoundMap

Values:
- "bark"
- "ow ow ow"
- "meow"

Keys:
- "dog"
- "seal"
- "cat"

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HashMap<String, String> animalSoundMap =
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HashMap<String, String> animalSoundMap =
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// 3. Get things out of the map
animalSoundMap.get("dog"); // "woof"
animalSoundMap.get("fox"); // null
HashMaps on one slide

1. Make a HashMap

        HashMap<keyType, valueType> myMap =
        new HashMap<keyType, valueType>();

2. Put and get values into a map

        myMap.put(key, value);
        myMap.get(key) // returns the corresponding value

3. Some useful other methods

        int size = myMap.size();
        myMap.containsKey(key); // returns true or false if key is in map
        myMap.keySet();
        myMap.remove(key); // make like a tree and leave!

4. Iterate using a foreach loop

        for(keyType key : myMap.keySet()){
            myMap.get(key); // do something with the key/value pair
        }
Phone Book

- Micah Cratty
- Waddie CrazyHorse
- Bryce Cronkite-Ratcliff
- Collin Cronkite-Ratcliff
- Ben Cunningham
- Lynn Cuthriell
- Waseem Daher
- Red Daly
- Richard Davis
- Philippe de Koning
- Hans Dejong

6701678

- addToPhoneBook
- printPhoneBook
- lookup
Mpedigree?
Make a keyboard

keyboardC.txt

<table>
<thead>
<tr>
<th>File</th>
<th>Frequency</th>
<th>Offset</th>
<th>Velocity</th>
<th>Trig</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4.wav</td>
<td>100.0</td>
<td>0</td>
<td>50</td>
<td>true</td>
</tr>
<tr>
<td>D4.wav</td>
<td>150.0</td>
<td>0</td>
<td>50</td>
<td>true</td>
</tr>
<tr>
<td>E4.wav</td>
<td>200.0</td>
<td>0</td>
<td>50</td>
<td>true</td>
</tr>
</tbody>
</table>
Why is this so fast?

Google search for "mantis shrimp colors"

About 1,870,000 results (0.54 seconds)

Humans and many other primates have three; some birds and reptiles have four photoreceptors. Certain butterflies can even have six. But the mantis shrimp has 12 different types of photoreceptors in their eyes – and scientists haven't understood why until now. Jan 27, 2014

Study Offers Insights into Unique Color Vision of Mantis Shrimp...
Why is this so fast?

int hash(string key);