Maps
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Why is this so fast?

Where are we?
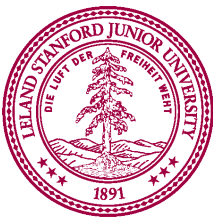
Control Flow

Variables

Collections

Collections High Level

```
  List:    ArrayList<type>

 Array:    type[]

Matrix:    type[][]
```

Collections High Level

```
List:     ArrayList<String>

Array:    double[]

Matrix:   int[][]
```
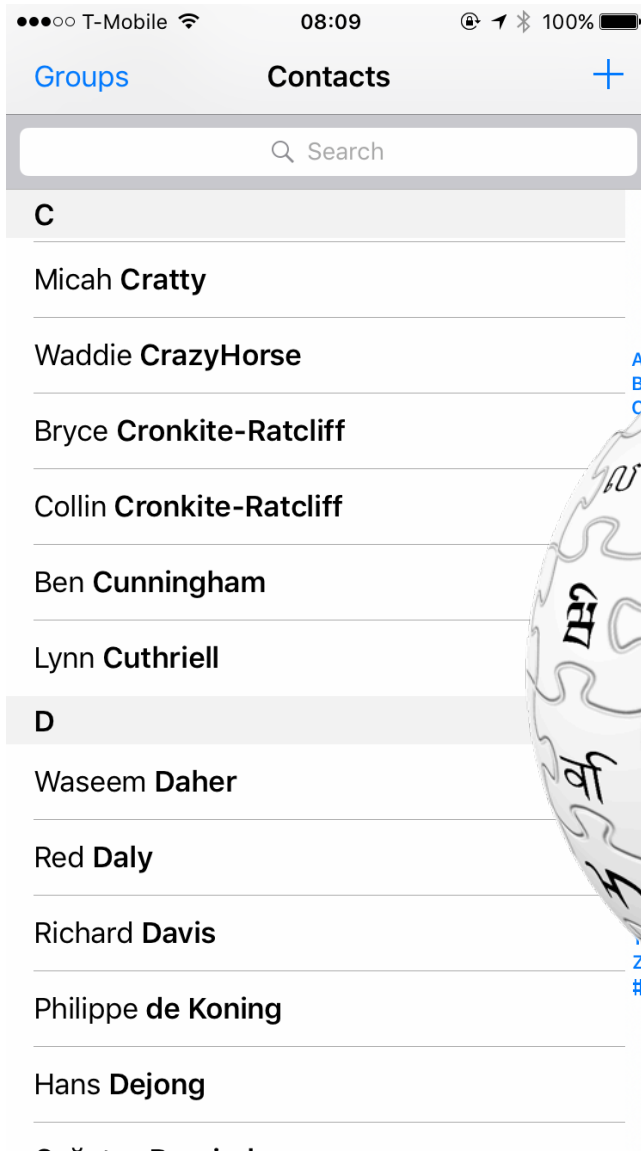
ArrayList
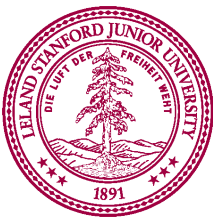index -> value

Arrays
index -> value

Matrix
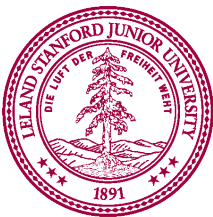## (row, col) -> value

Maps can have any type for key

Many examples

HashMap
key -> value

Simple Example

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"]
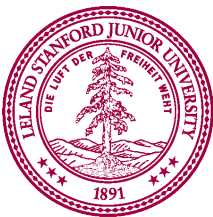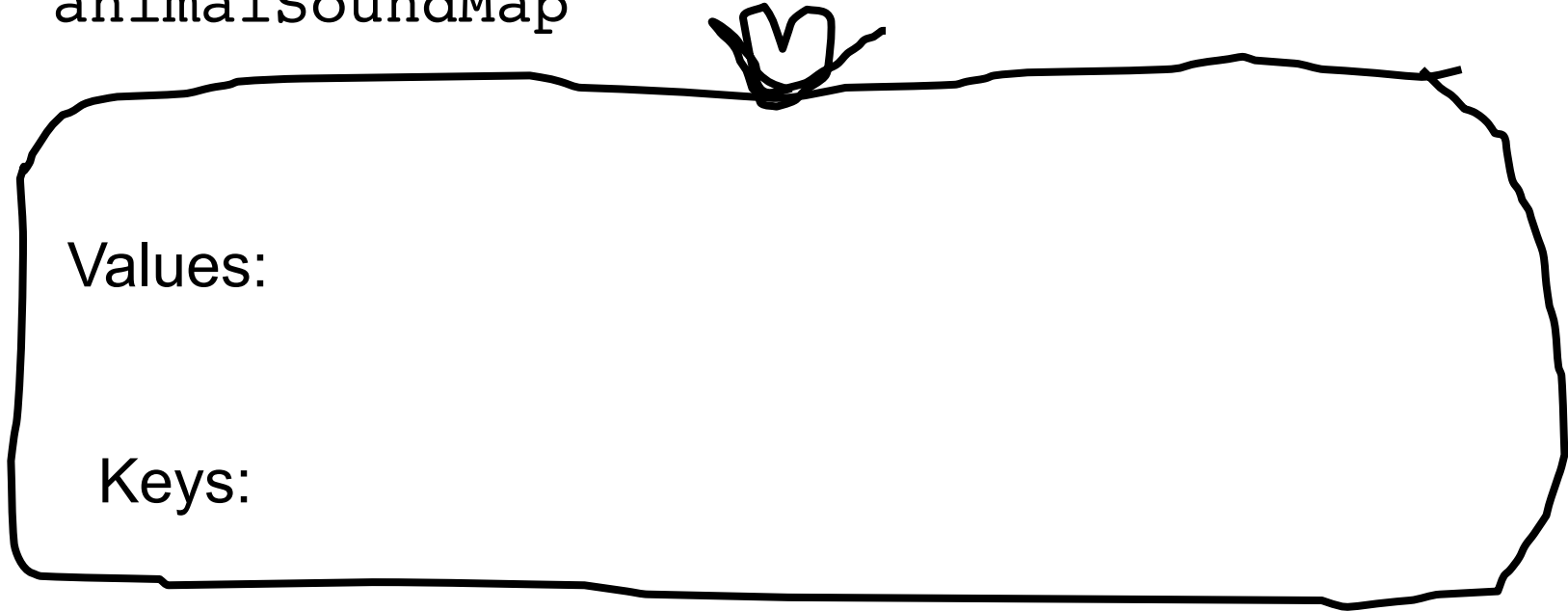
Simple Example

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   Get [key = "dog"]

Simple Example

`animalSoundMap`

Values:

Keys:

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Simple Example

animalSoundMap

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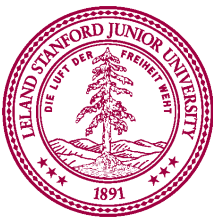
3. Get elements:
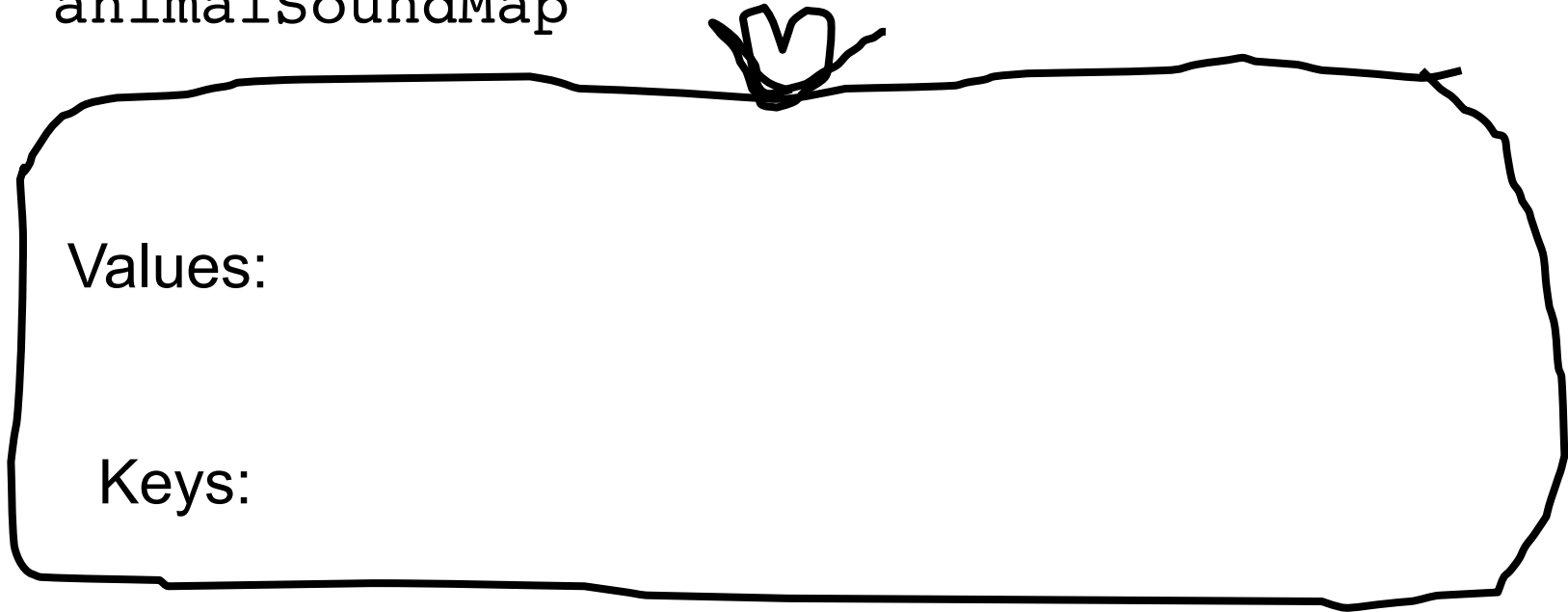   Get [key = "dog"]

Simple Example

animalSoundMap

Values:

"bark"

Keys: "dog"

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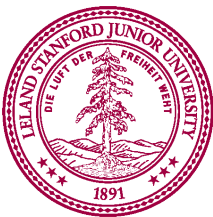
3. Get elements:
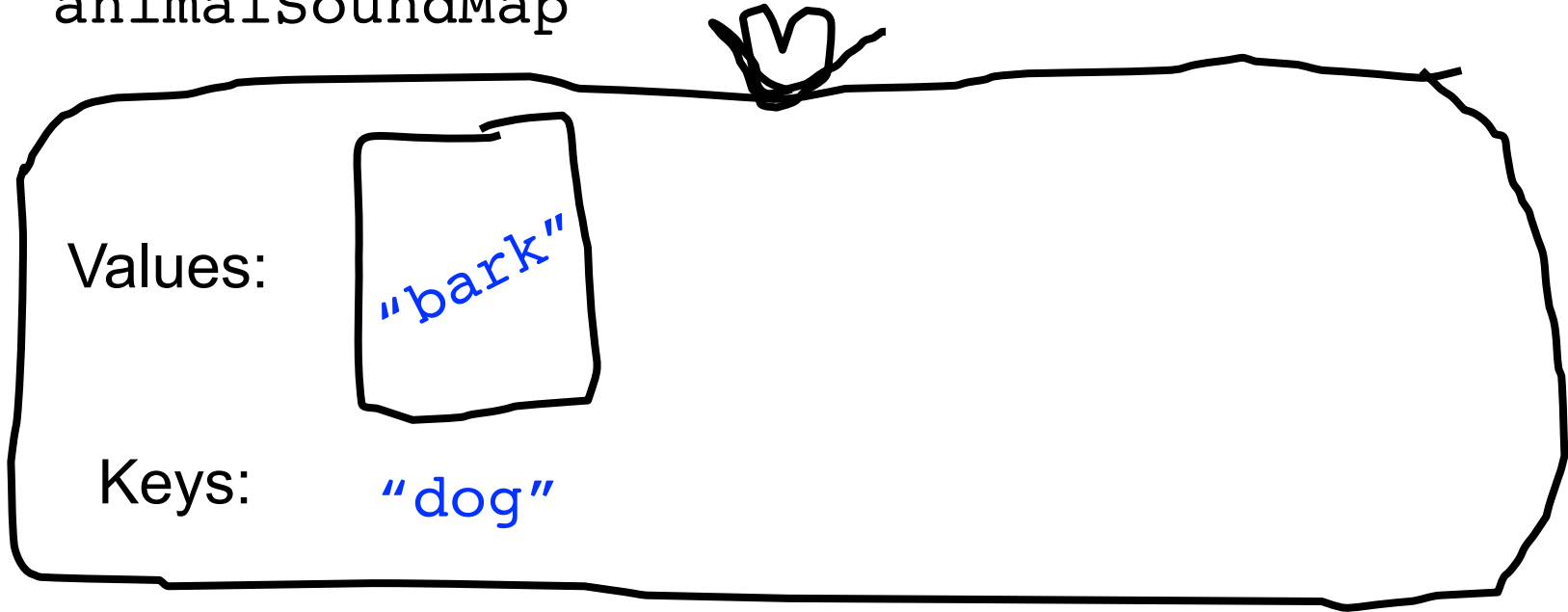   Get [key = "dog"]

Simple Example

animalSoundMap

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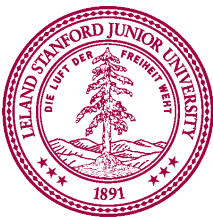
3. Get elements:
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Simple Example

animalSoundMap

Values: "bark"   "meow"

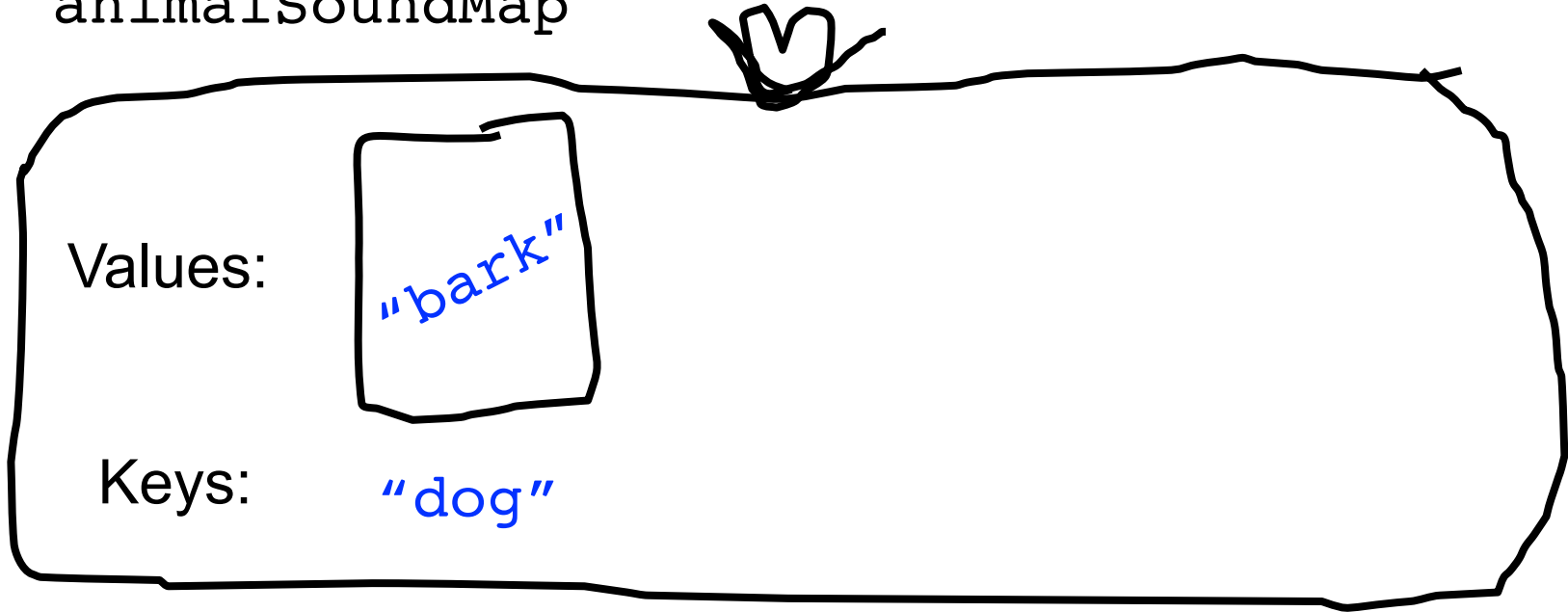Keys: "dog"   "cat"

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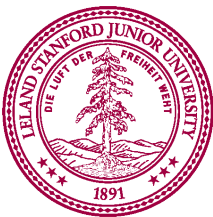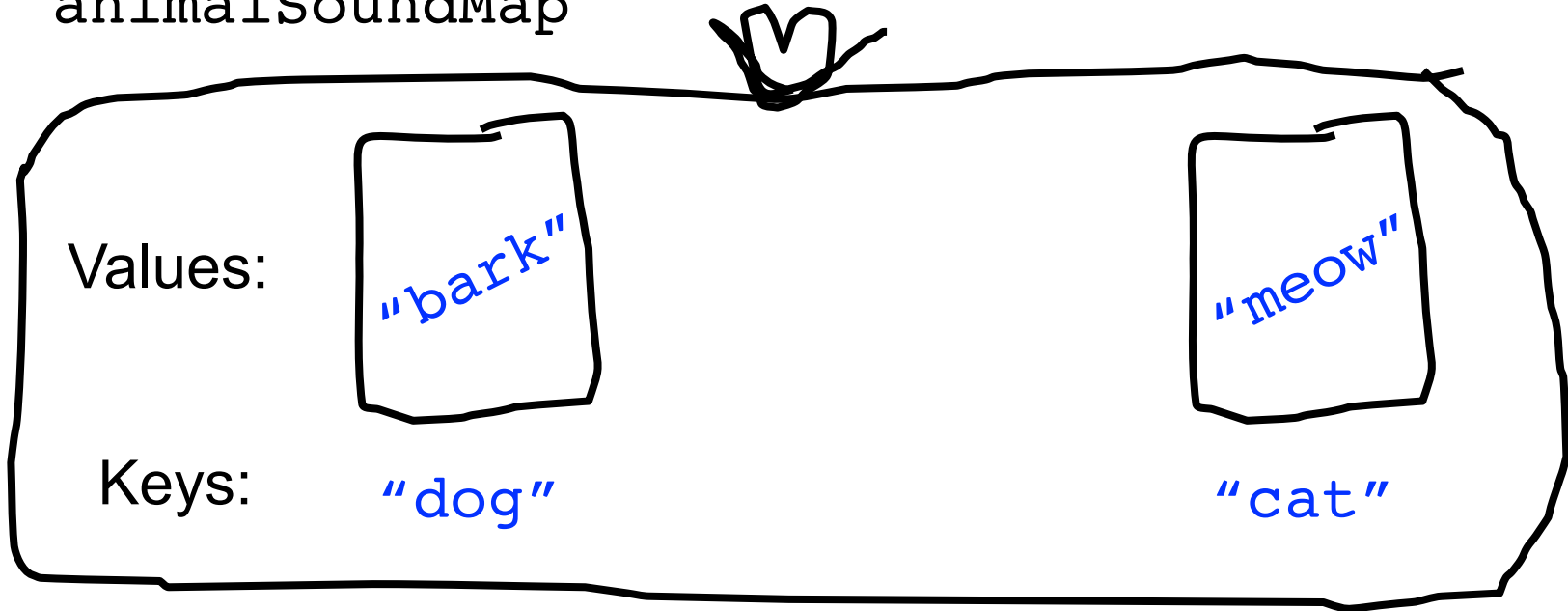3. Get elements:
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Simple Example

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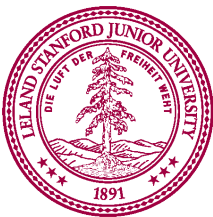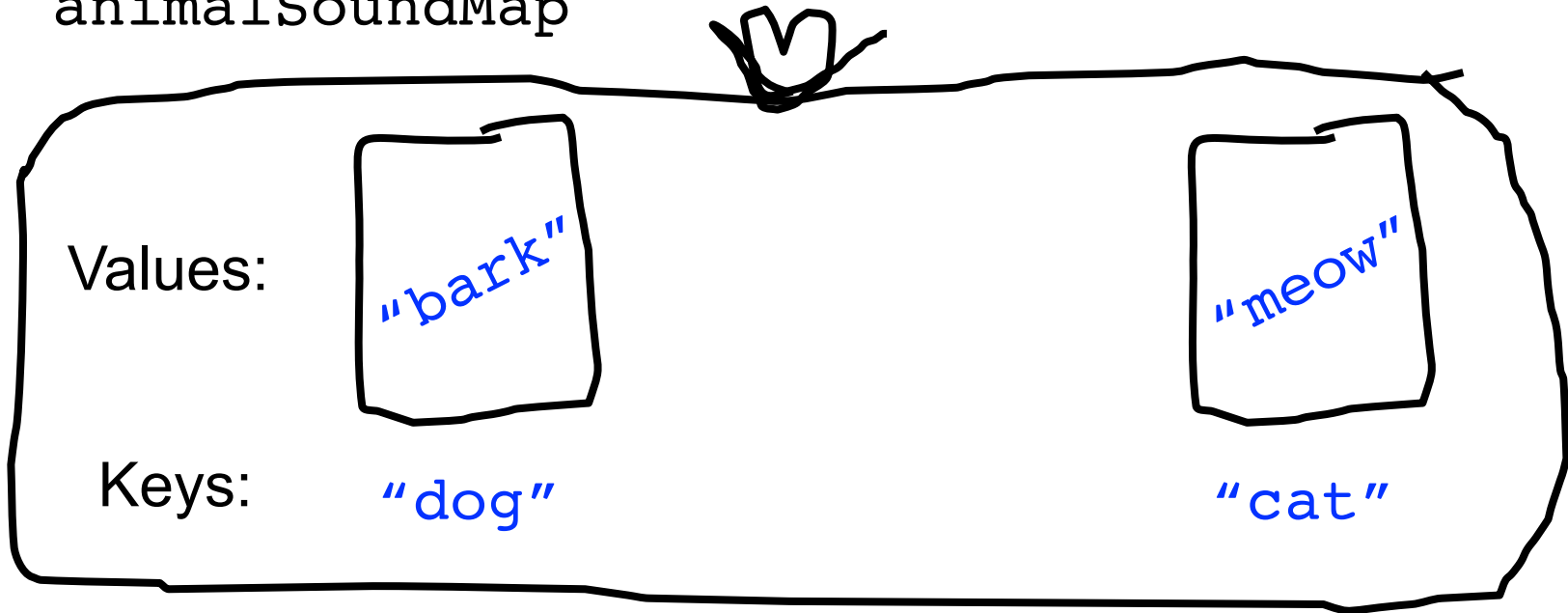
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Simple Example

animalSoundMap

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Keys: "dog" "seal" "cat"

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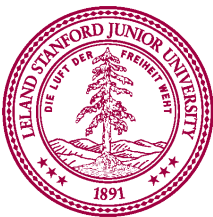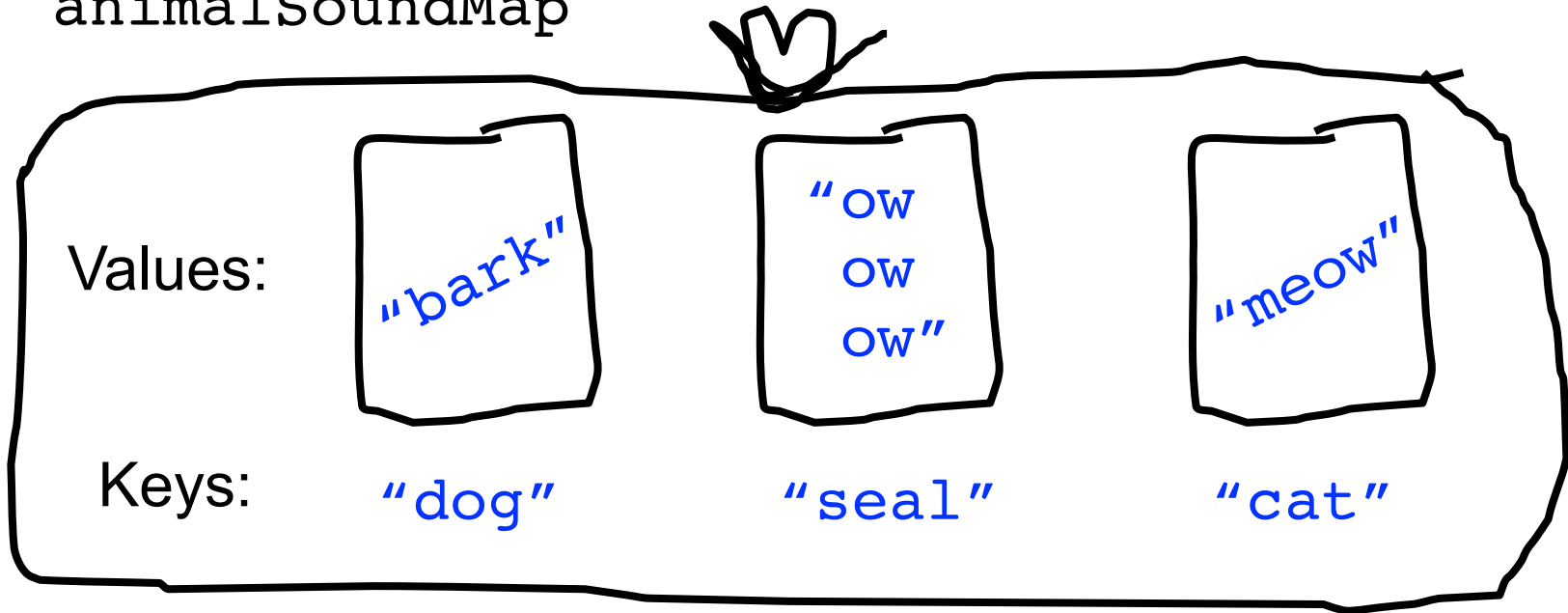
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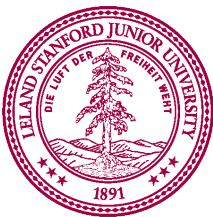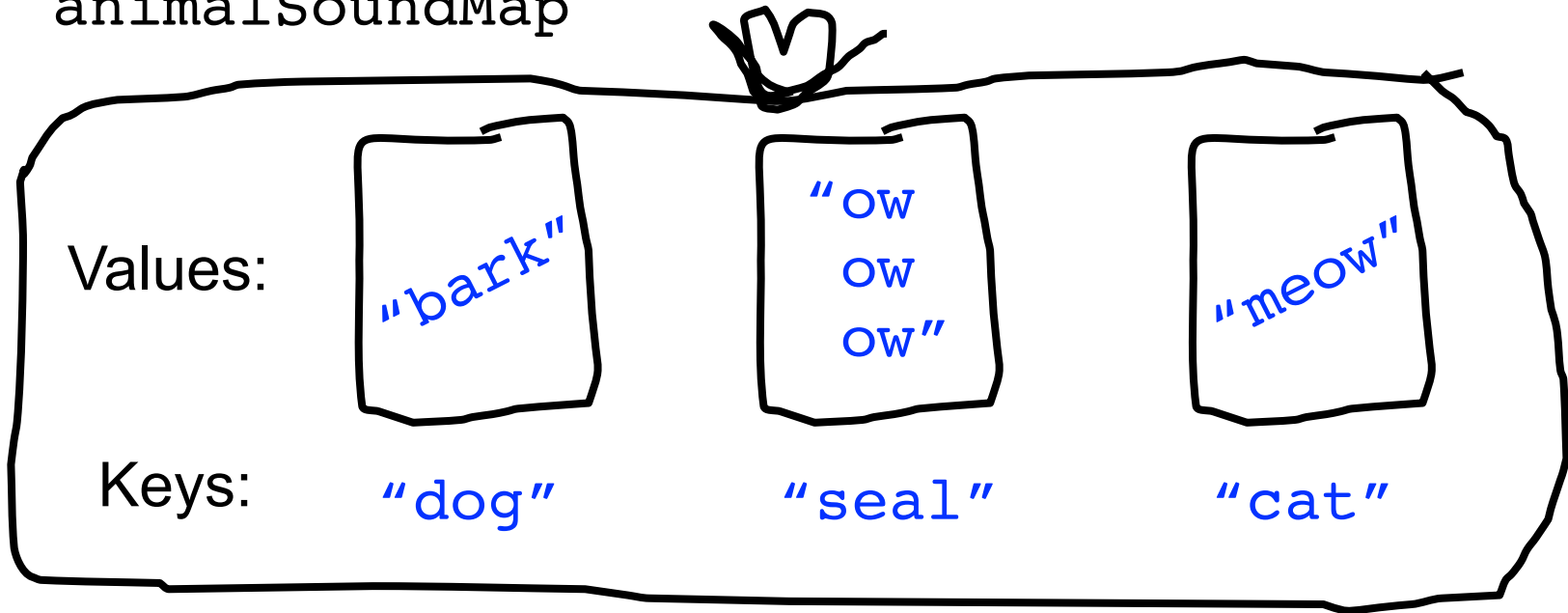3. Get elements:
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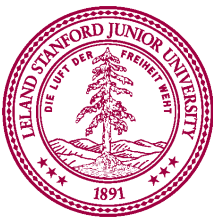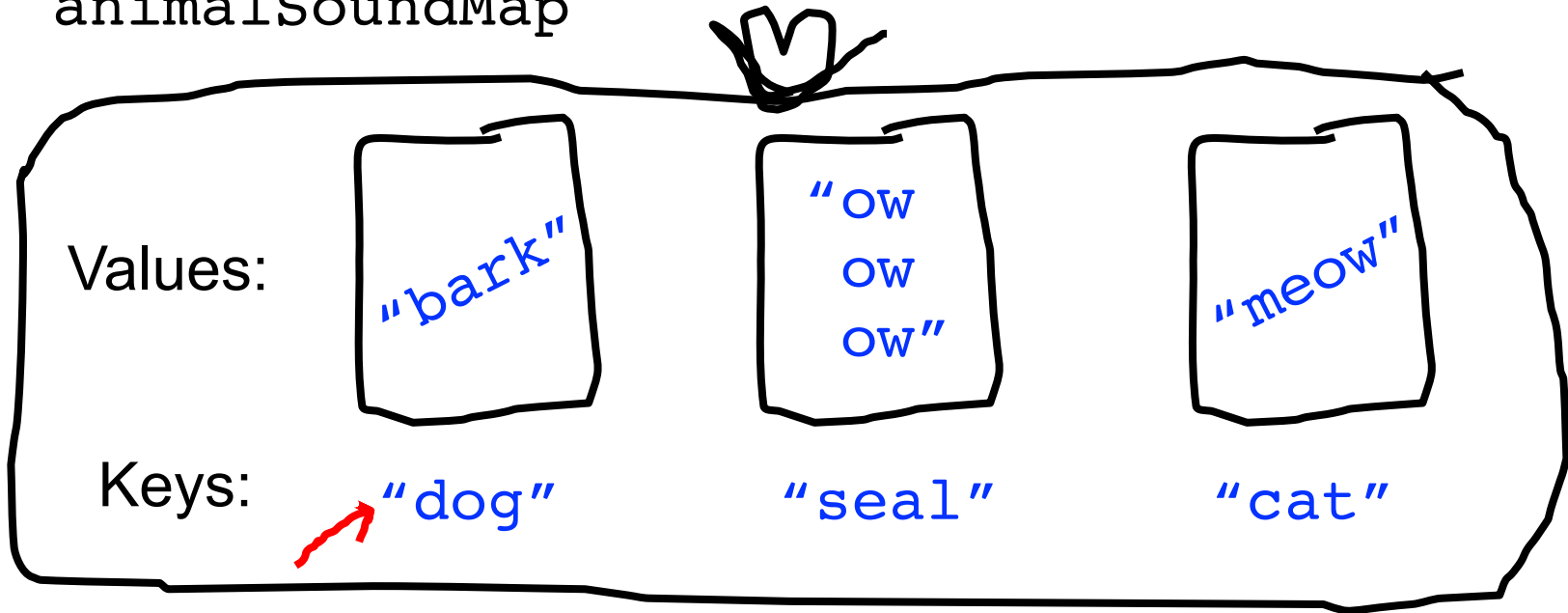
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Simple Example

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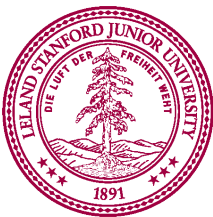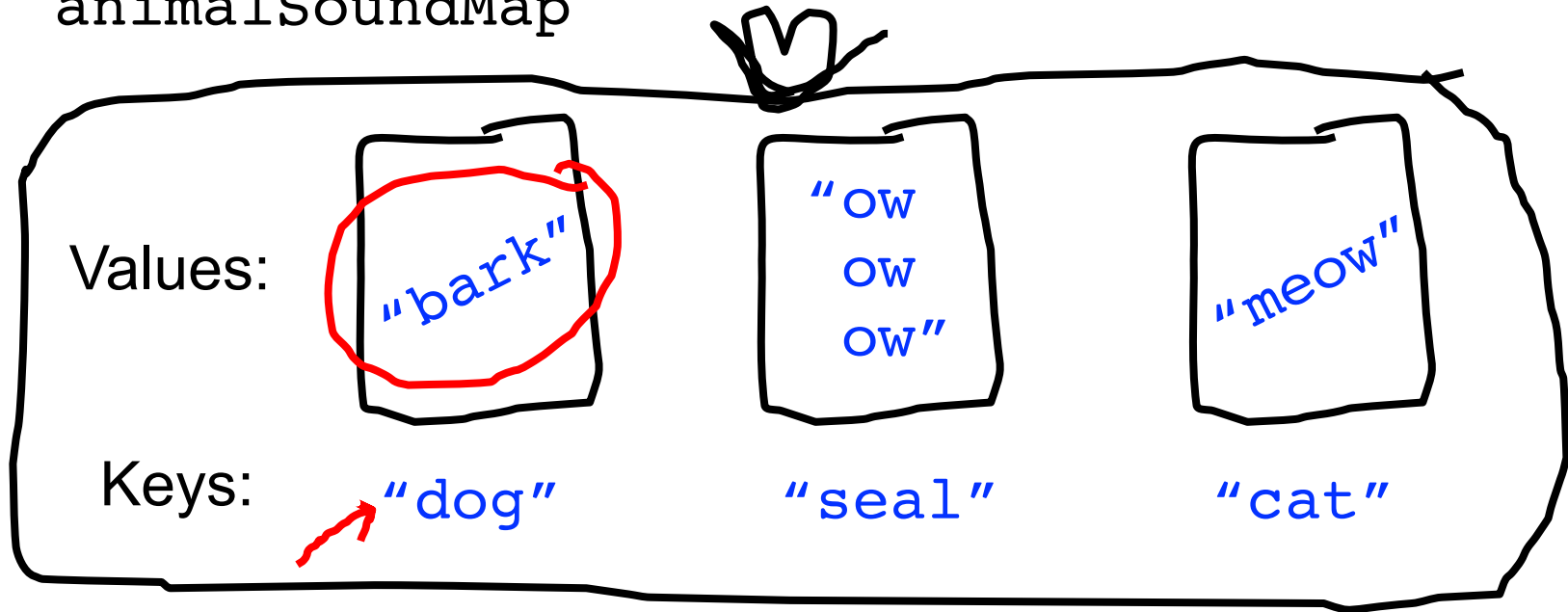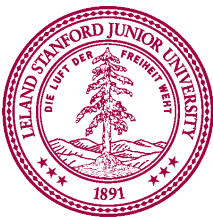
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Simple Example

animalSoundMap

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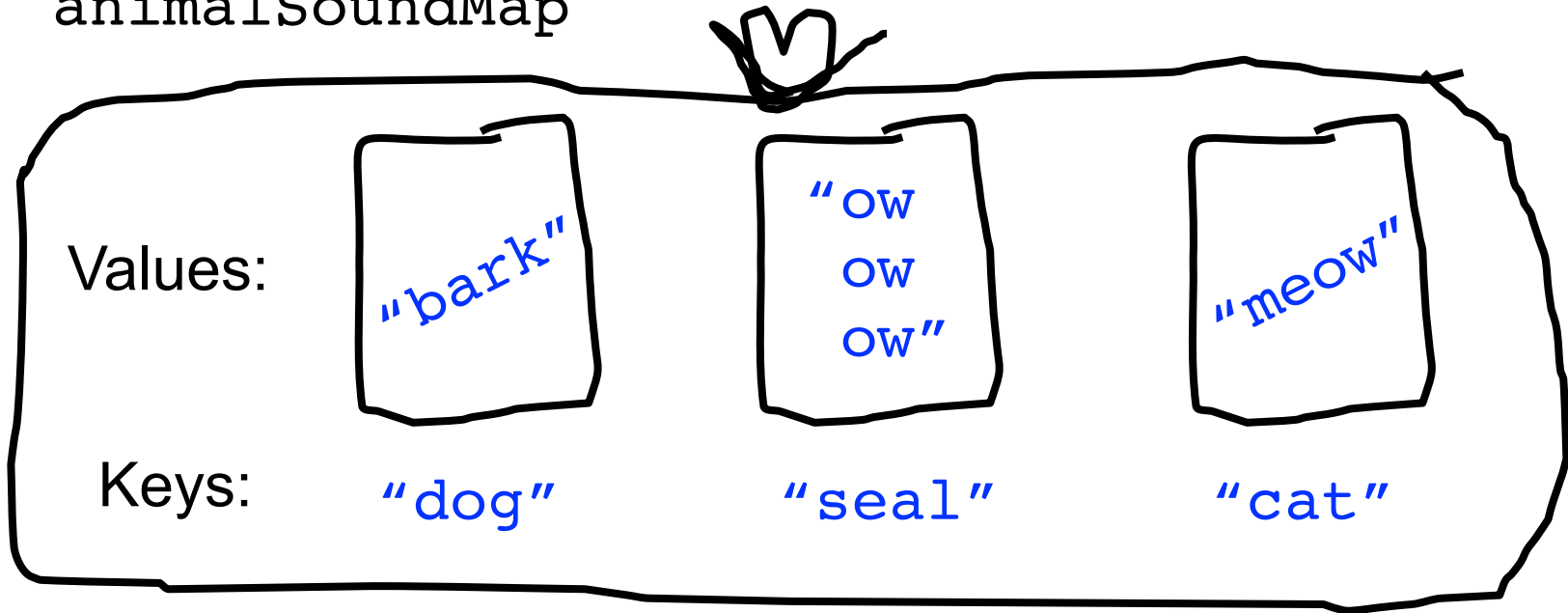Keys: "dog"   "seal"   "cat"

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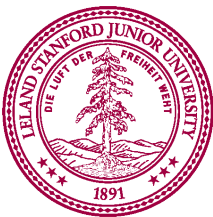   Put [key="seal", value="ow ow ow"]

3. Get elements:
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Simple Example

animalSoundMap

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

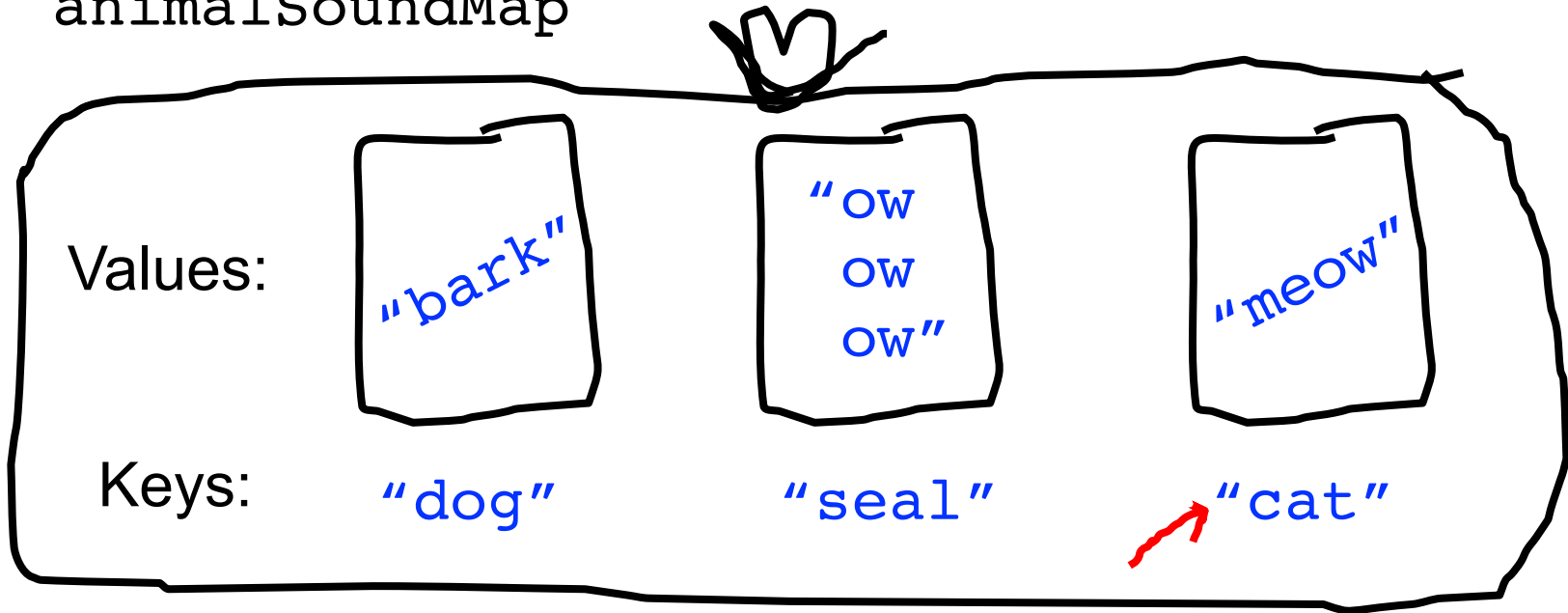Keys: "dog"   "seal"   "cat"

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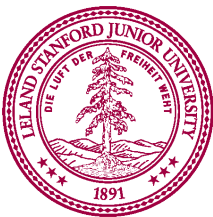3. Get elements:
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Simple Example

animalSoundMap

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

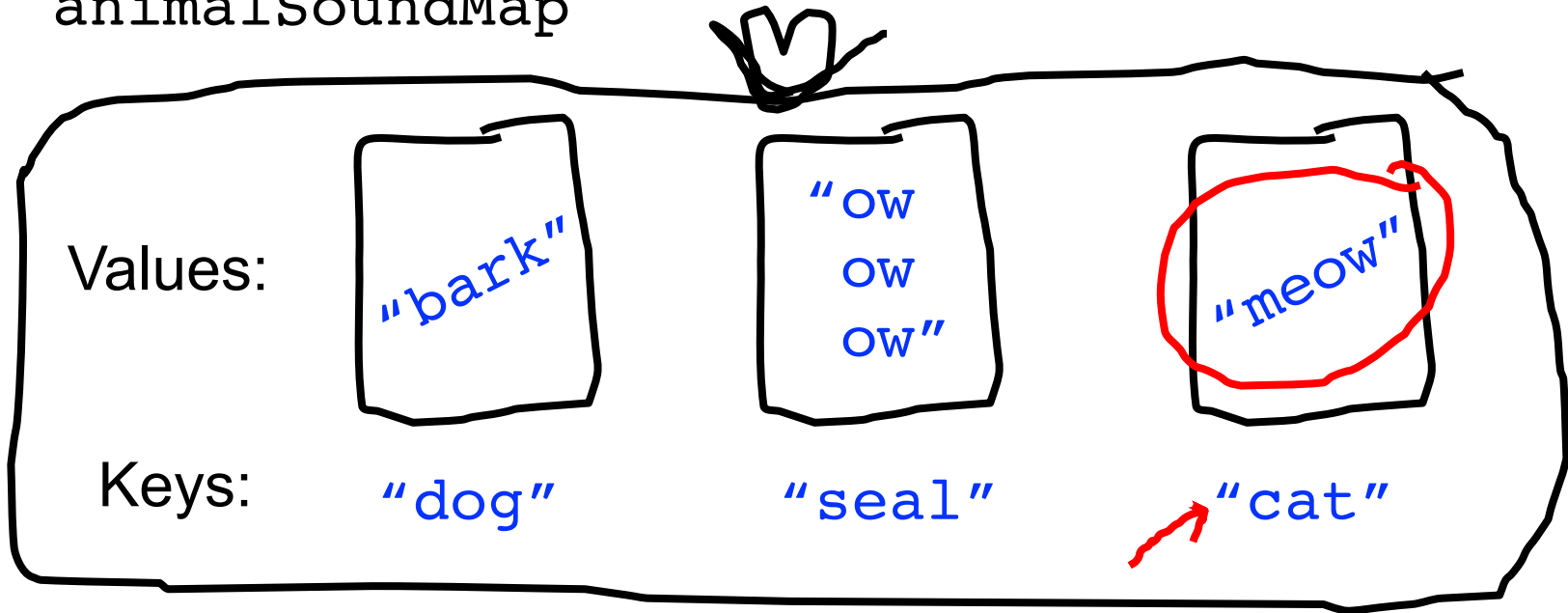Keys: "dog"   "seal"   "cat"

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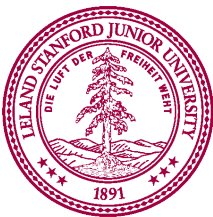
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My First Map

```
HashMap<String, String> animalSoundMap =
        new HashMap<String, String>();
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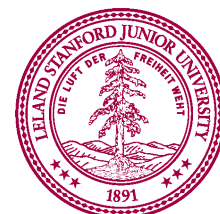
My First Map

Key Type

Value Type

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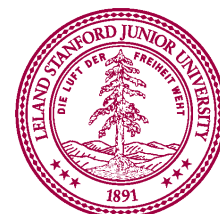# My First Map

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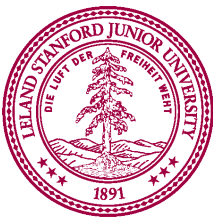
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animalSoundMap.put("dog", "bark");
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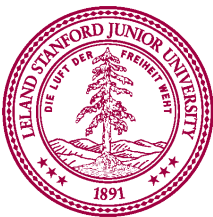# My First Map

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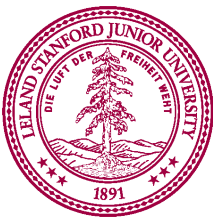# My First Map

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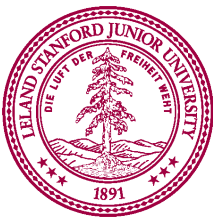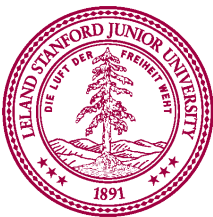
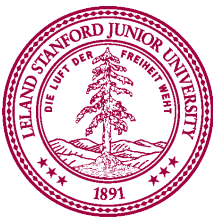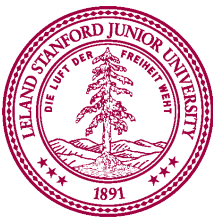# My First Map

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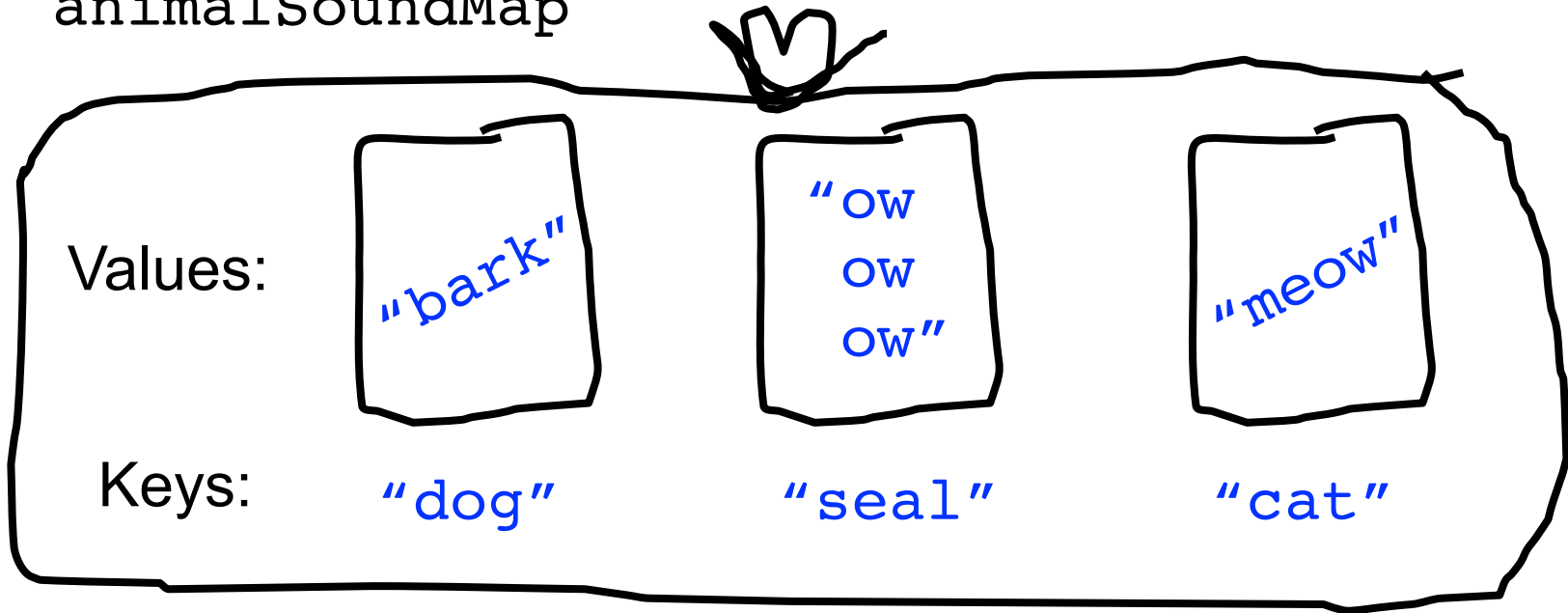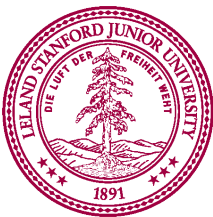
My First Map

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HashMap<String, String> animalSoundMap =
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animalSoundMap.put("dog", "bark");

animalSoundMap.get("dog");
```

My First Map

animalSoundMap

Values: "bark" "ow ow ow" "meow"
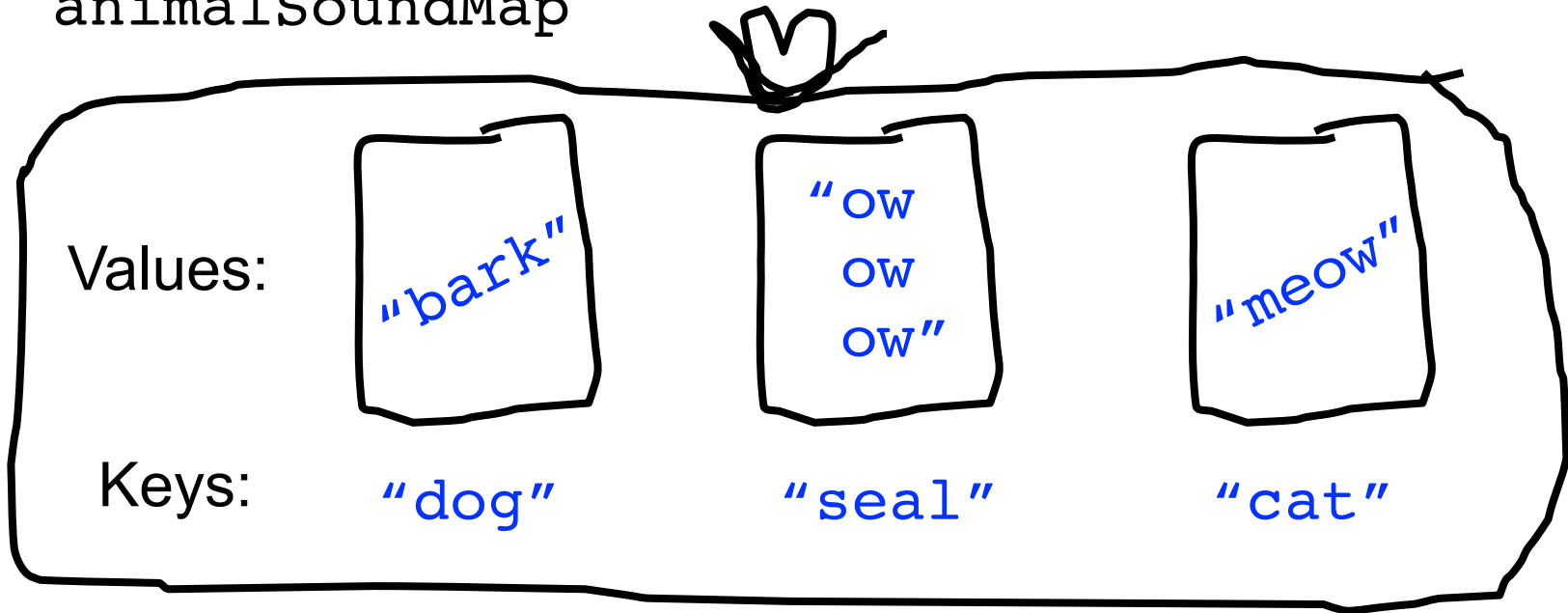
Keys: "dog" "seal" "cat"

1. Make a new HashMap of animal sound

2. Add elements:
   Put [key = "dog", value = "bark"]
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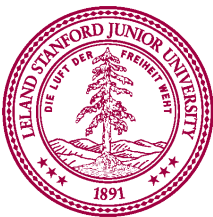3. Get elements:
   Get [key = "dog"]

My First Map

animalSoundMap

Values:

"bark"

"ow ow ow"

"meow"

Keys: "dog"   "seal"   "cat"

```java
// 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"
```
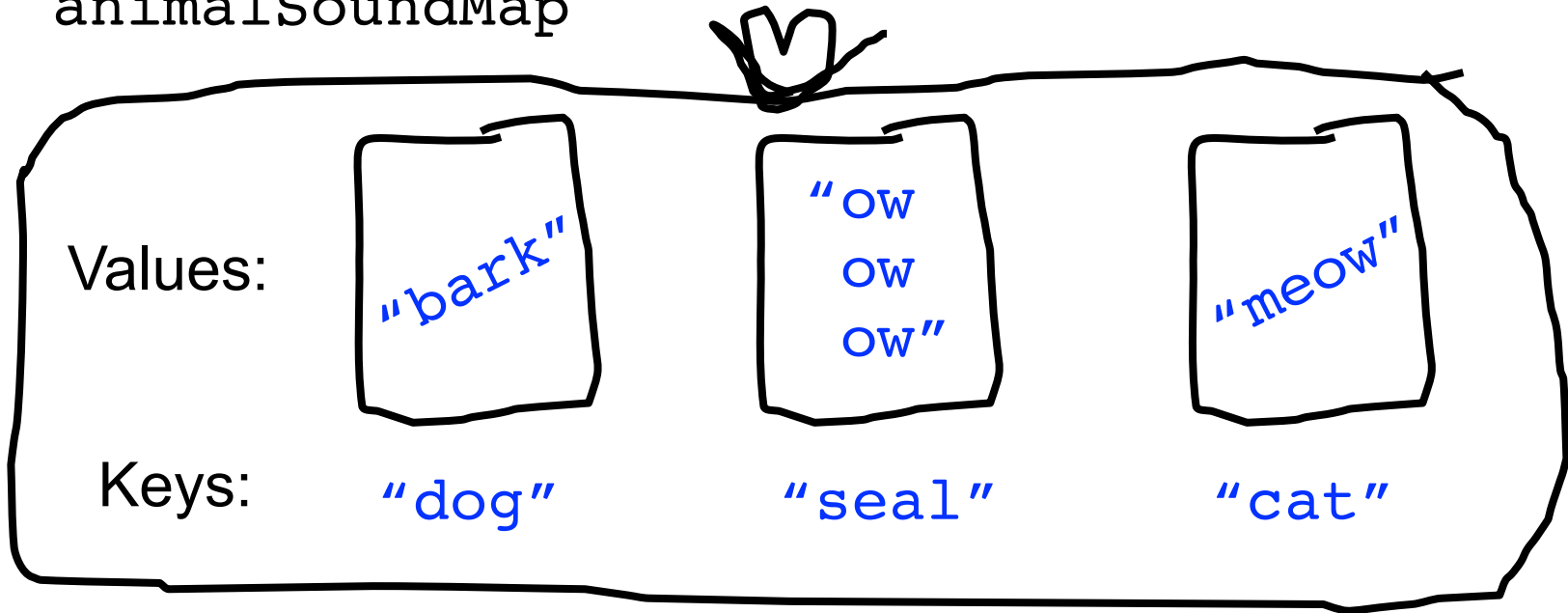
My First Map

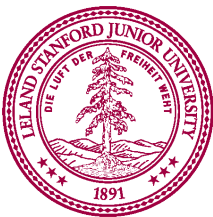animalSoundMap

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animalSoundMap.put("seal", "ow ow ow");

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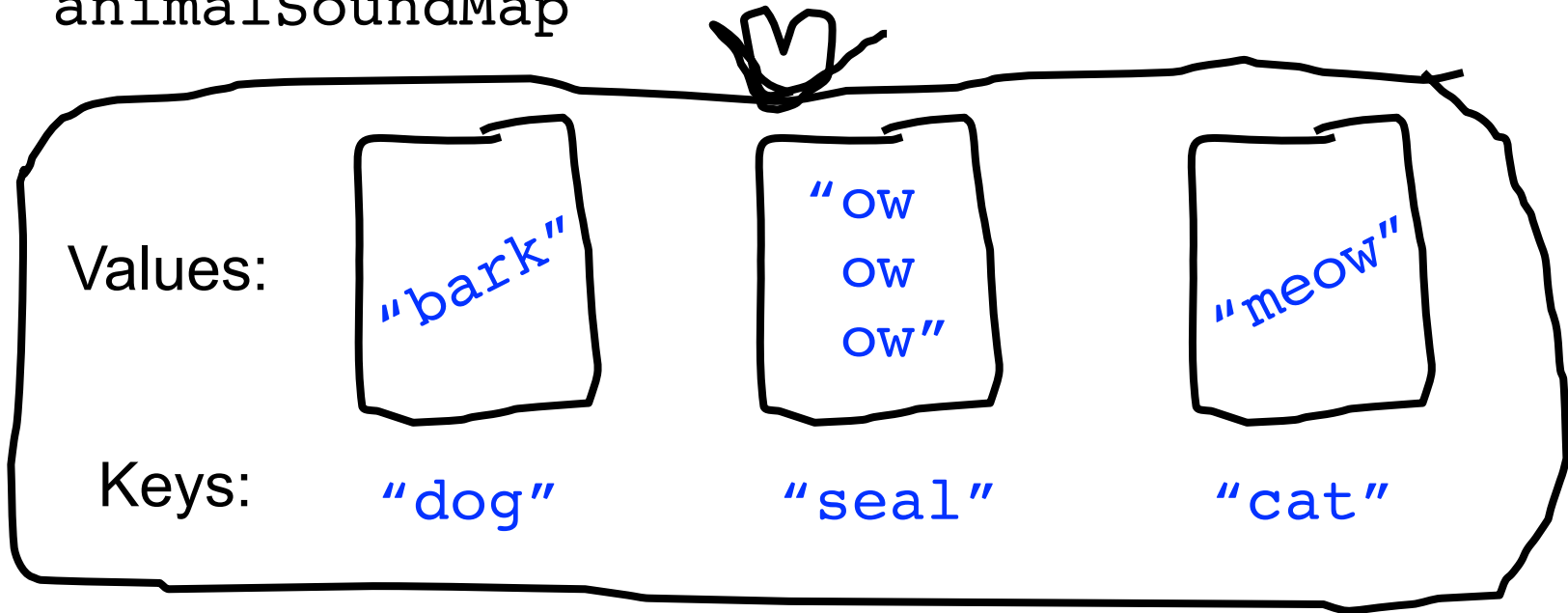
brothers Vegard
and Bård Ylvisåker

Circa 2013

But there's one sound

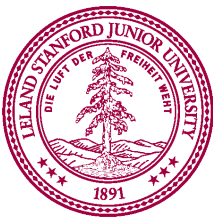Ylvis – "The Fox". Permission asked. Pending.

My First Map

animalSoundMap

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

Keys: "dog"   "seal"   "cat"

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animalSoundMap.get("fox"); // ?
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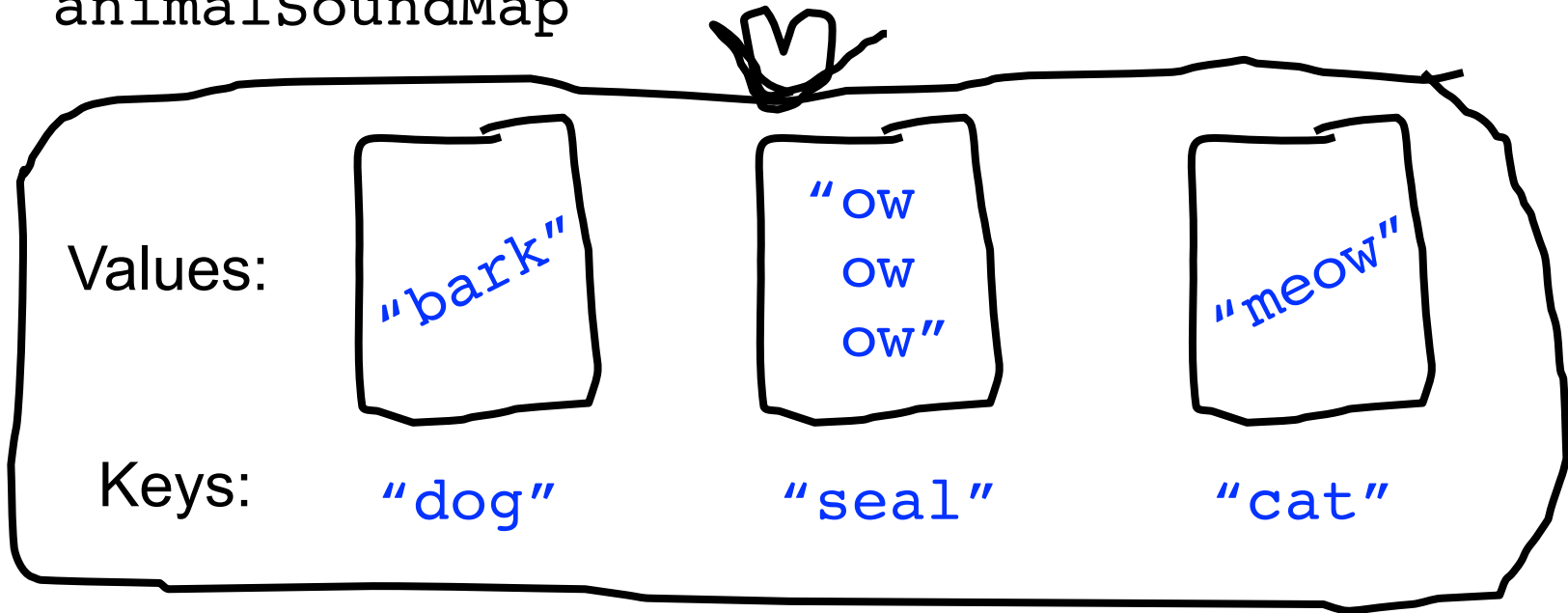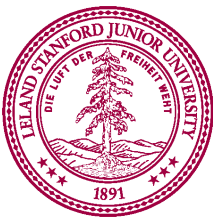
My First Map

animalSoundMap

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

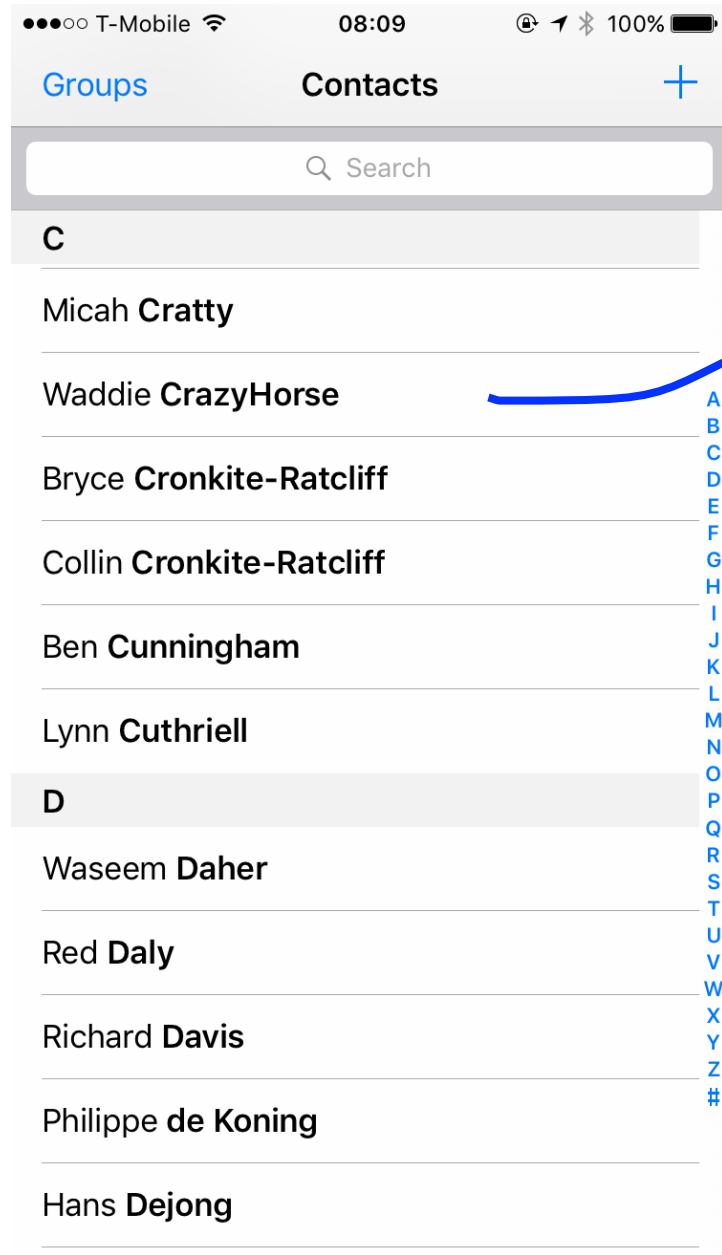Keys: "dog"   "seal"   "cat"

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// 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"); // null
```

Phone Book

6701678

HashMaps on one slide

1. Make a HashMap

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

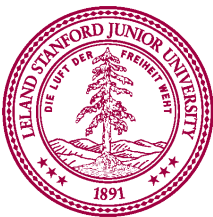2. Put and get values into a map

   ```
   myMap.put(key, value);
   myMap.get(key) // returns the corresponding value
   ```
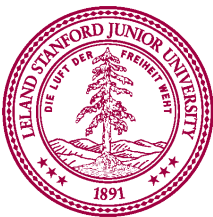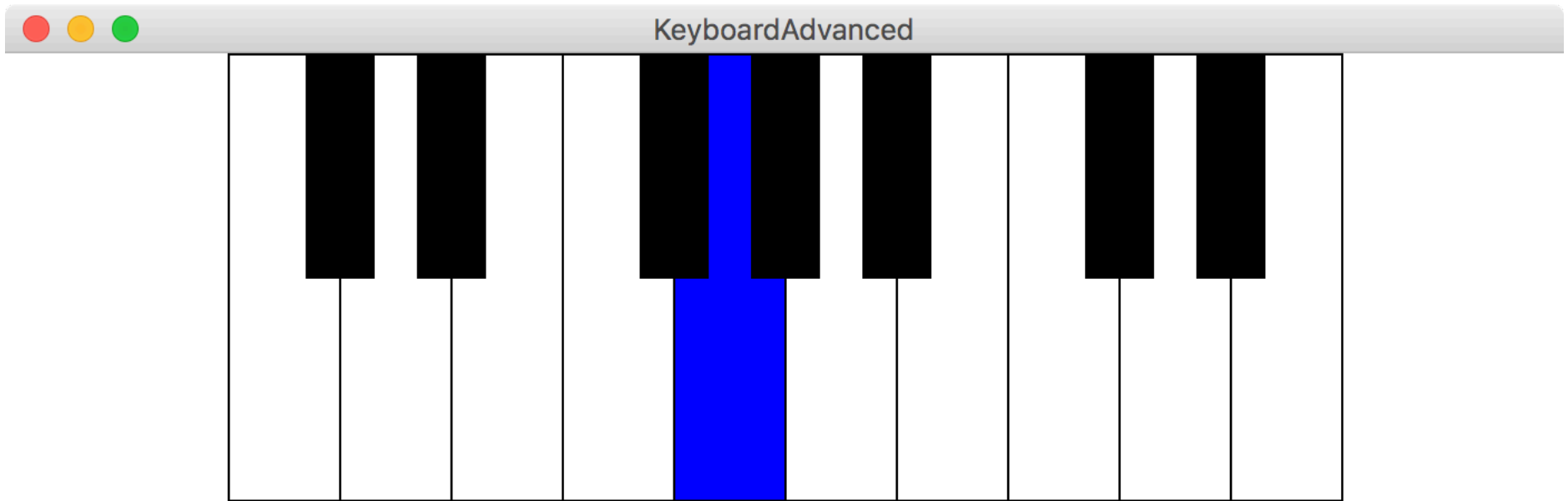
3. Some useful other methods

   ```
   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()){  // not ordered
      myMap.get(key); // do something with the key/value pair
   }
   ```

Make a keyboard

Why is this so fast?

Why is this so fast?


```
int hash(string key);
```

* Learn more in CS106B