Parsing JSON, Using Libraries, Java Collections, Generics

How hard was first code review assignment?

A) Easy

B) Moderate

C) Challenging

D) Unreasonable

How long did first assignment take?

A) Less than 2 hours

B) 2 to 4 hours

C) 4 to 6 hours

D) 6 to 8 hours

E) More than 8 hours

Grading

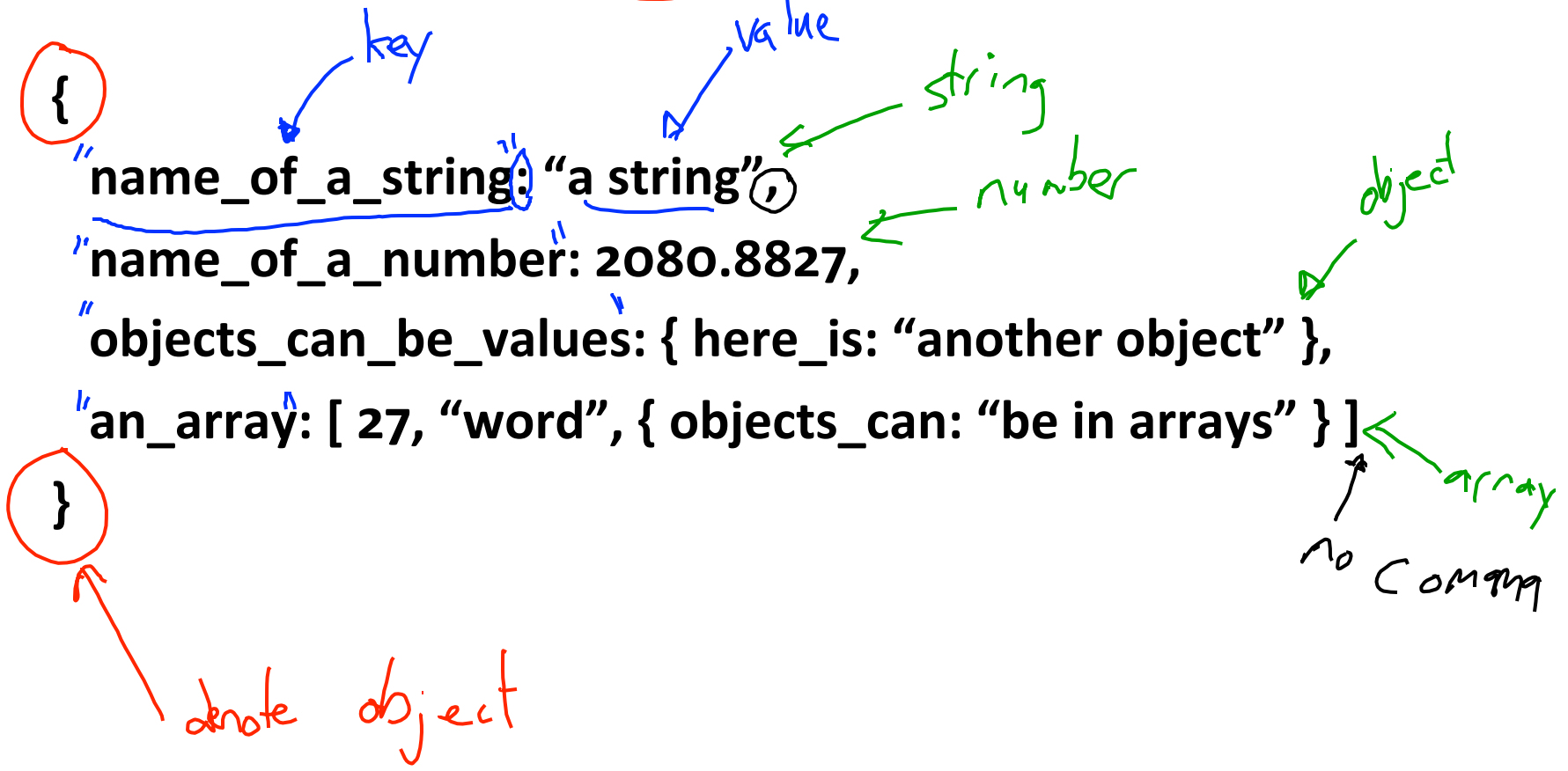
- **Code Reviews (50%)**
- **Final Android Project (30%)**
- **Participation (20%)**
  - 5% iClickers (3% attendance, 2% performance)
  - 5% from short assignments (based on readings)
  - 5% from in-class quizzes (announced/unannounced) and (non-Unix) PrairieLearn homework
  - 5% from Unix assignments

JSON (www.json.org)

- **JavaScript Object Notation**

- **A lightweight data-interchange format**
  - Very commonly used by APIs
- **It is easy for humans to read and write.**
- **It is easy for machines to parse and generate.**

Example JSON object



Using APIs (e.g., https://newsapi.org)

- **API = Application Programming Interface**
- **Get an API key**

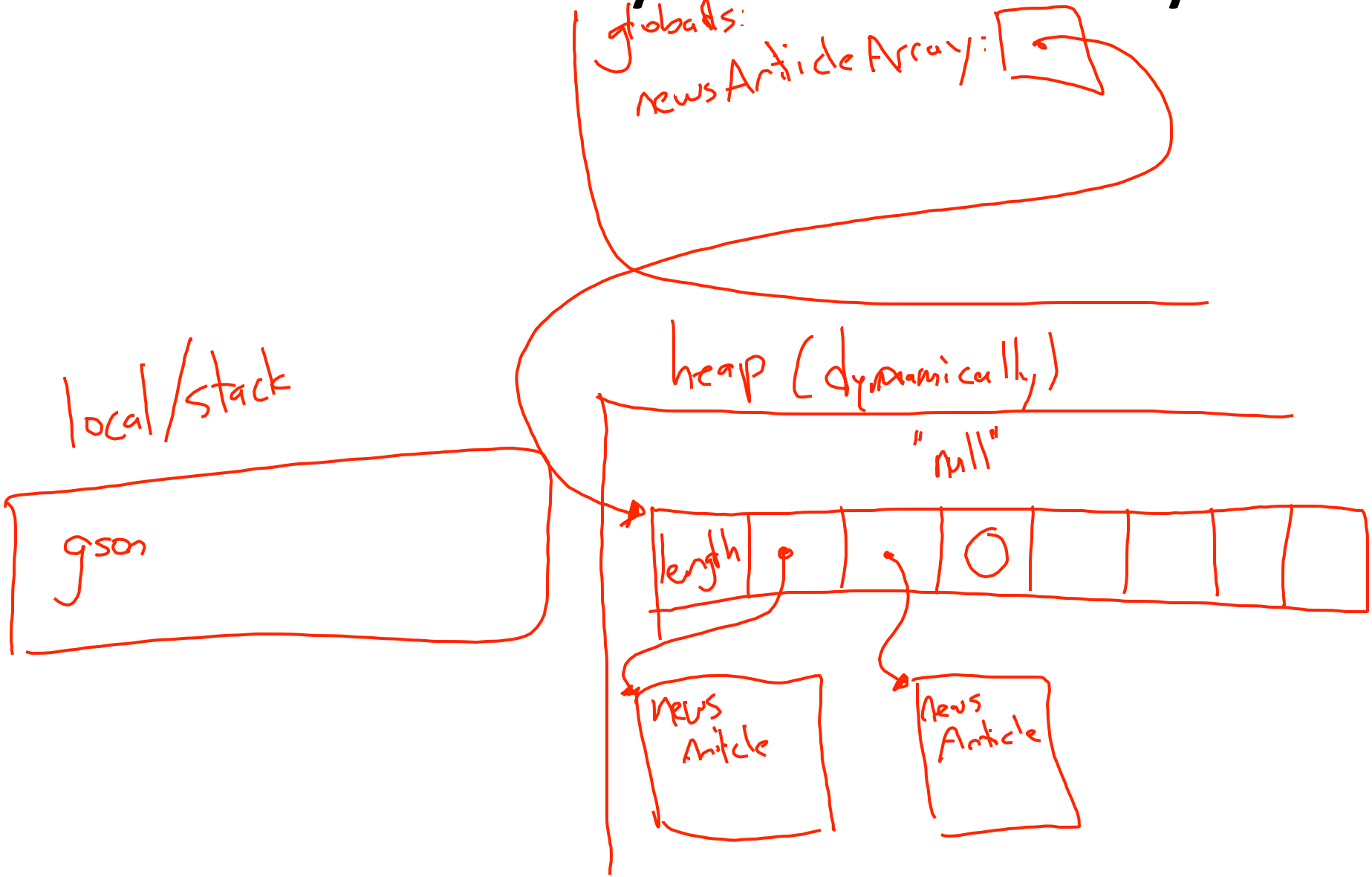
- **Grab some JSON:**
  - https://newsapi.org/v1/articles?source=associated-press&sortBy=top&apiKey=YOUR_API_KEY_HERE

- **JSON formatter/pretty printer**
  - https://jsonformatter.curiousconcept.com
  - There are a bunch of these, use your favorite

Parsing JSON in Java

- **Use the GSON library from Google**
  - https://github.com/google/gson/blob/master/UserGuide.md
  - Use Maven to add the library to your project
- **Build classes with fields for the desired elements of the JSON**
  - Use the same names and get the types right
- **Instantiate a Gson object**
  - Gson gson = new Gson();
- **Use the fromJSON method to parse the JSON**
  - Thing newThing = gson.fromJson(jsonString, Thing.class);
  - Thing [] thingArray = gson.fromJson(jsonString, Thing[].class);
- **Extended example using NewsAPI**

What does a Java Array look like in memory



What if we want to filter News Articles?

- E.g., only select those articles with non-null authors
- What should be the return type of such a function?

One Implementation

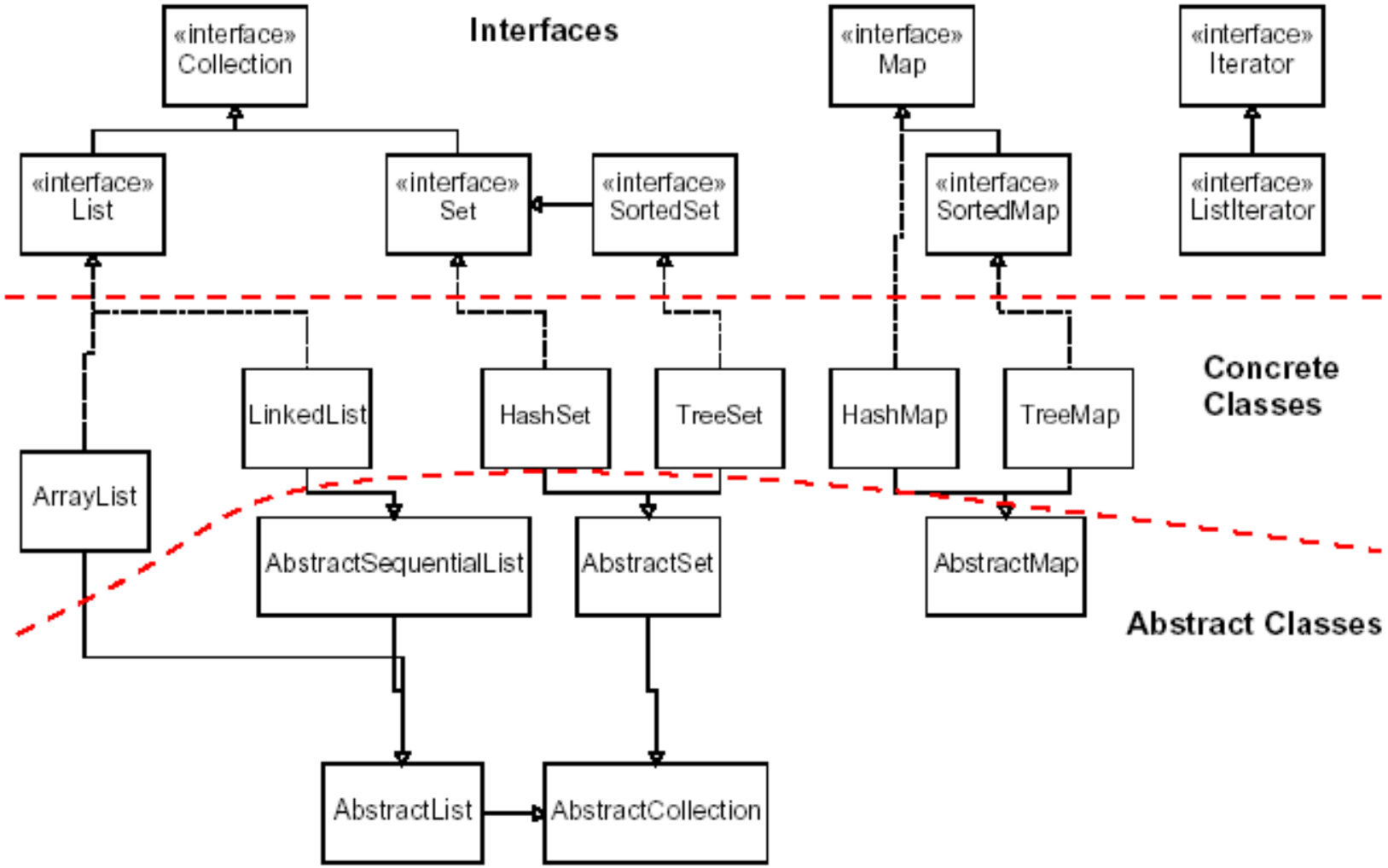
```
public NewsArticle[]
removeNullAuthorArticles(NewsArticle[] input) {
    // output array can't be bigger than input array
    NewsArticle [] output = new NewsArticle[input.length];
    int outputIndex = 0;

    for (int i = 0; i < input.length; i++) {
        if (input[i].getAuthor() != null) {
            output[outputIndex] = input[i];
            outputIndex ++;
        }
    }

    return output;
}
```

Java Collections

- **collection: an object that stores data; a.k.a. "data structure"**
  - the objects stored are called **elements**
  - some collections maintain an ordering; some allow duplicates
  - typical operations: *add*, *remove*, *clear*, *contains* (search), *size*
  - examples found in the Java class libraries:
    - `ArrayList`, `HashMap`, `TreeSet`
  - all collections are in the `java.util` package

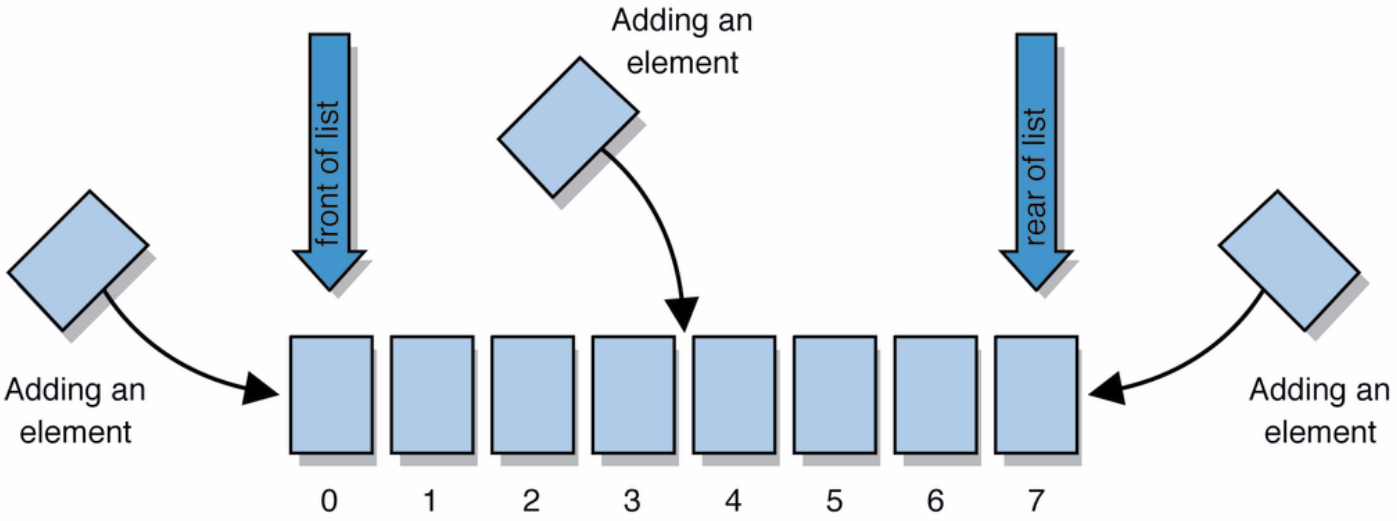
```
import java.util.*;
```

Java Collection Framework



Lists

- **list: a collection storing an ordered sequence of elements**
  - each element is accessible by a 0-based **index**
  - a list has a **size** (number of elements that have been added)
  - elements can be added to the front, back, or elsewhere
  - in Java, a list can be represented as an **`ArrayList`** object



ArrayList Methods (partial list)

`add(`**value**`)`	appends value at end of list
`add(`**index**`, `**value**`)`	inserts given value just before the given index, shifting subsequent values to the right
`clear()`	removes all elements of the list
`indexOf(`**value**`)`	returns first index where given value is found in list (-1 if not found)
`get(`**index**`)`	returns the value at given index
`remove(`**index**`)`	removes/returns value at given index, shifting subsequent values to the left
`set(`**index**`, `**value**`)`	replaces value at given index with given value
`size()`	returns the number of elements in list
`toString()`	returns a string representation of the list such as `"[3, 42, -7, 15]"`

Generics

```
ArrayList<Type> name = new ArrayList<Type>();
```

- **When constructing an `ArrayList`, you must specify the type of elements it will contain between < and >.**
  - This is called a *type parameter* or a *generic* class.
  - Allows the same `ArrayList` class to store lists of different types.
  - Must be objects (vs. primitive types)

Boxed Primitive Types

- **Can't do ArrayList<int>**
- **Java provides "boxed primitives": E.g., Integer**
  - Sub-class of object
- **Can do:**
  - ArrayList<Integer> lengths = new ArrayList<Integer>
  - lengths.add(7); // automatically promoted to boxed type

Primitive Type	Wrapper Type
`int`	`Integer`
`double`	`Double`
`char`	`Character`
`boolean`	`Boolean`

To Dos for Tuesday

- **Read chapter 4 of your book "Aesthetics"**
- **Read section 4 (Formatting) of the Google Java Style Guide**
- **Assignment for next week's code review:**
  - Parsing JSON for UofI course grade distributions
  - Filtering and aggregating data from this sources
  - Out soon (I hope…)