Collections & Regex

MCIT 591 Online

Agenda

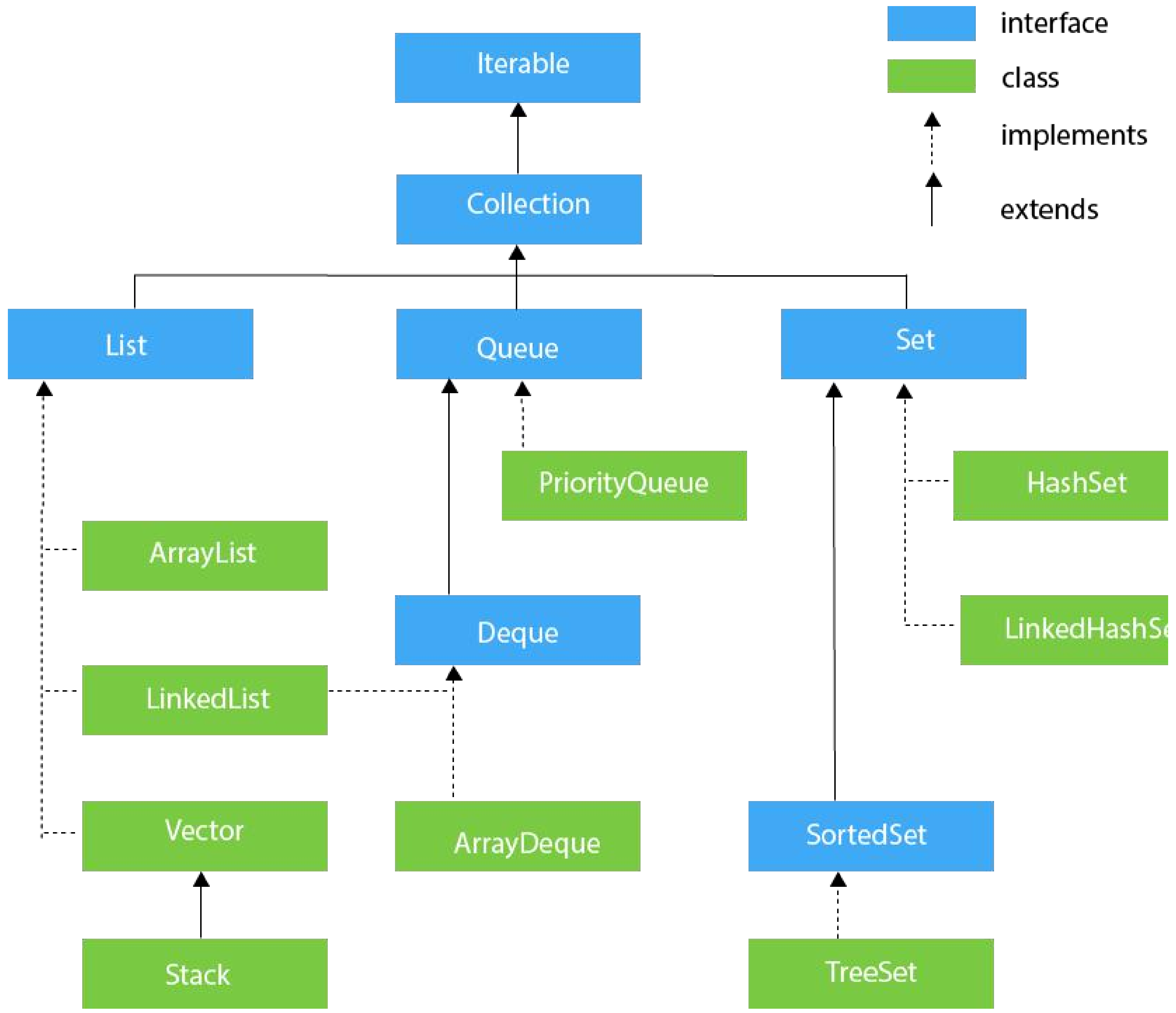
- Course Materials
- Practice Assignment Review
- Homework 9: Student Management System

Collection: a structured group of objects

- The Collection interface is the root interface of the Collection hierarchy
- Types of Collections (subinterface):
    - List(ArrayList): May contain duplicate elements, order is important
        - ArrayList is an implementation of List, which is a subinterface of Collection
        - Array is not a collection
    - Set: Cannot contain duplicate elements, order is not important
    - SortedSet: Like a Set, but order is important
- Types of Collection-like (subinterface):
    - Map: A “dictionary” that associates keys with values, where order is not important
    - SortedMap: A map where order is important

Collection: a structured group of objects

- Each interface has at least one implementation.
- List – ArrayList, LinkedList
- Deque (Double-ended queue, front & rear) – ArrayDeque, ConcurrentLinkedDeque, LinkedList
- Set – HashSet, LinkedHashSet,
  - SortedSet - TreeSet
- Map – HashMap,
  - SortedMap - TreeMap


interface
class
implements
extends
Iterable
Collection
List
Queue
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PriorityQueue
HashSet
ArrayList
Deque
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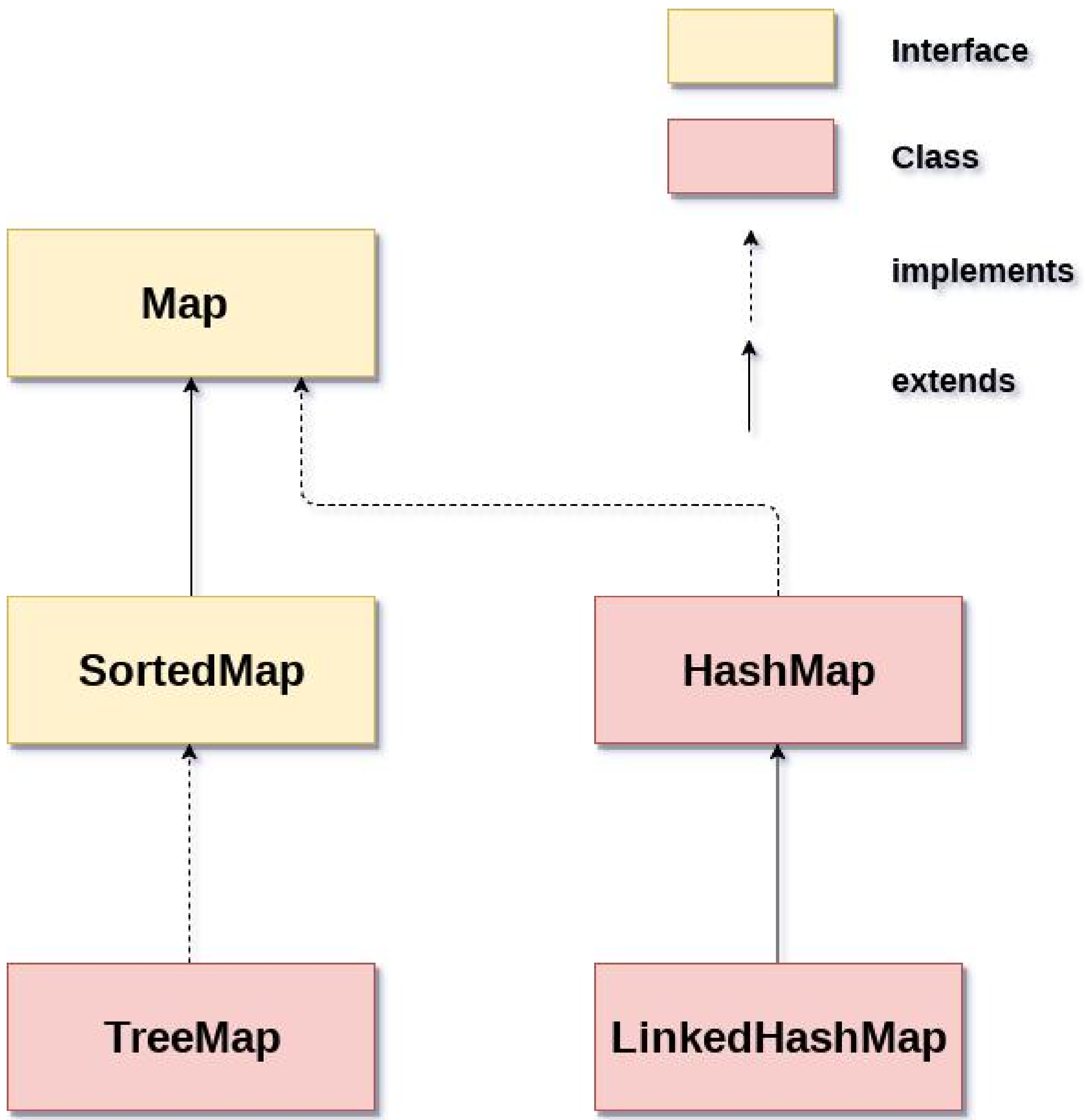
ArrayDeque
SortedSet
Stack
TreeSet


Interface
Class
implements
extends
Map
SortedMap
HashMap
TreeMap
LinkedHashMap

Methods in the Collection Interface

- All subinterfaces include the methods in the Collection interface
- For example
  - boolean add(E o)
  - boolean contains(Object o)
  - boolean remove(Object o)
  - boolean isEmpty()
  - int size()
  - Object[] toArray()
  - Iterator<E> iterator()

Methods in the Subinterfaces of Collection

- List interface
    - void add(int index, E element)
    - void set(int index, E element)
- Deque Interface
    - Element access only at the front or the rear of the Collection
    - Can be used as both a stack (LIFO) and a queue (FIFO)
        - LIFO: last in, first out
        - FIFO: first in, first out
    - void addFirst(E o), void addLast(E o)
    - E getFirst(), E getLast()
    - E removeFirst(), E removeLast()
- Set Interface

Methods in the Collection-like Interfaces

- Map Interface
  - Cannot contain duplicate keys
  - Each key can map to at most one value
  - Important methods:
    - V put(K key, V value)
    - V get(Object key)
    - It does not inherit Collection methods

General Rules for Selecting an Implementation

- List
  - If you need fast access to random elements in the list, choose the ArrayList.
  - If you will frequently remove or insert elements to the list, choose a LinkedList.
- Deque – If you only need access at the ends (beginning or end) of the sequence.
- Set
  - Use a TreeSet if you need to traverse the set in sorted order.
  - Otherwise, use a HashSet, it's more efficient.
- Map
  - Chose TreeMap if you want to access the collection in key order.
  - Otherwise, choose HashMap.

Iterator<E> iterator()

- Recall: we use for loop to iterate a list,
    - either with index: int i=0, i<n, i++
    - or in an element way: for (String s: ListOfString)
- Use an iterator instead of a for loop to <u>modify the collection while traversing</u>
    - A ConcurrentModificationException is thrown when a collection is modified while traversing, by any means other than through its iterator

Iterator<E> iterator()

```
//get iterator object
Iterator<String> it = treeSet.iterator();


//modify (remove) the values using the iterator while traversing the
treeset
while(it.hasNext()) {                      //if exist
    if(it.next().equals("red")) {          //access to the element
        it.remove();                       //modify the values
    }
}
```

Sorted order

- To store an object in a sorted Collection, the Object must have a natural order (numeric values)
- OR it must implement the Comparable interface compareTo (for example: alphabetically)
- Recall: Compare the two instance variables of an author's name

Example: CompareTo

- Here's an example Author class that implements Comparable and *compareTo*

```
public class Author implements Comparable<Author> {

    String firstName;
    String lastName;

    @Override
    public int compareTo(Author other) {
        //compare the names of authors
        //returns negative number if this is supposed to be less than the other
        //returns positive number if this is supposed to be greater than the other
        //otherwise returns 0 if they are supposed to be equal
        int last = this.lastName.compareTo(other.lastName);
        return last == 0 ? this.firstName.compareTo(other.firstName) : last;
    }
}
```

Static method

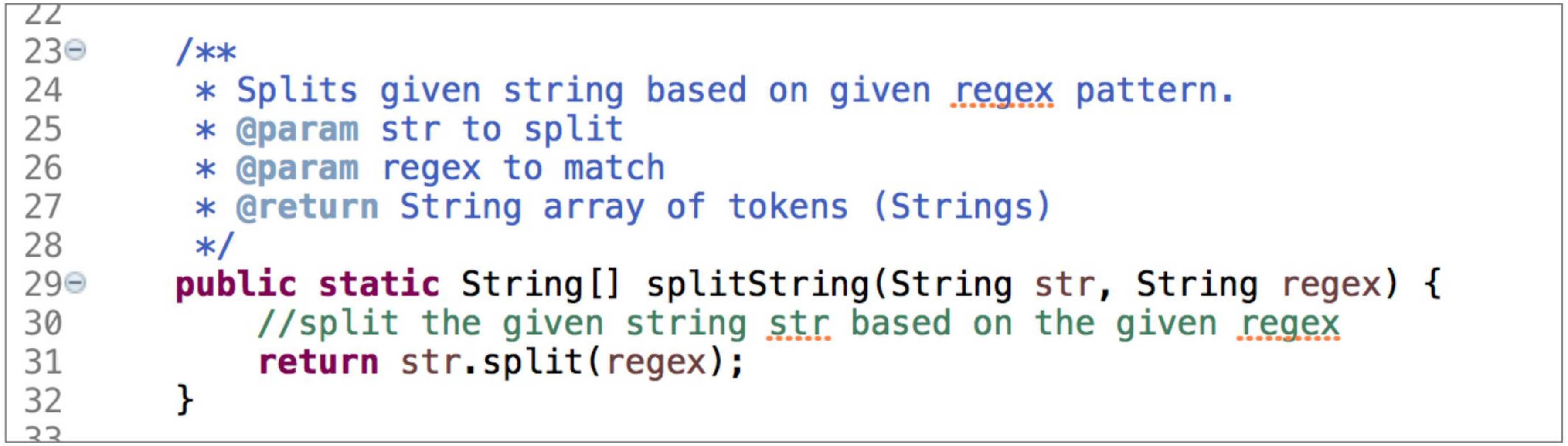
- The Collections class has some convenient static methods for working with collections
- For example:
    - Collections.sort()
        - sorts list
    - Collections.binarySearch(arrayList, String)
        - returns position in list where object is found

- Static methods of Array: Arrays.asList(), Arrays.sort()

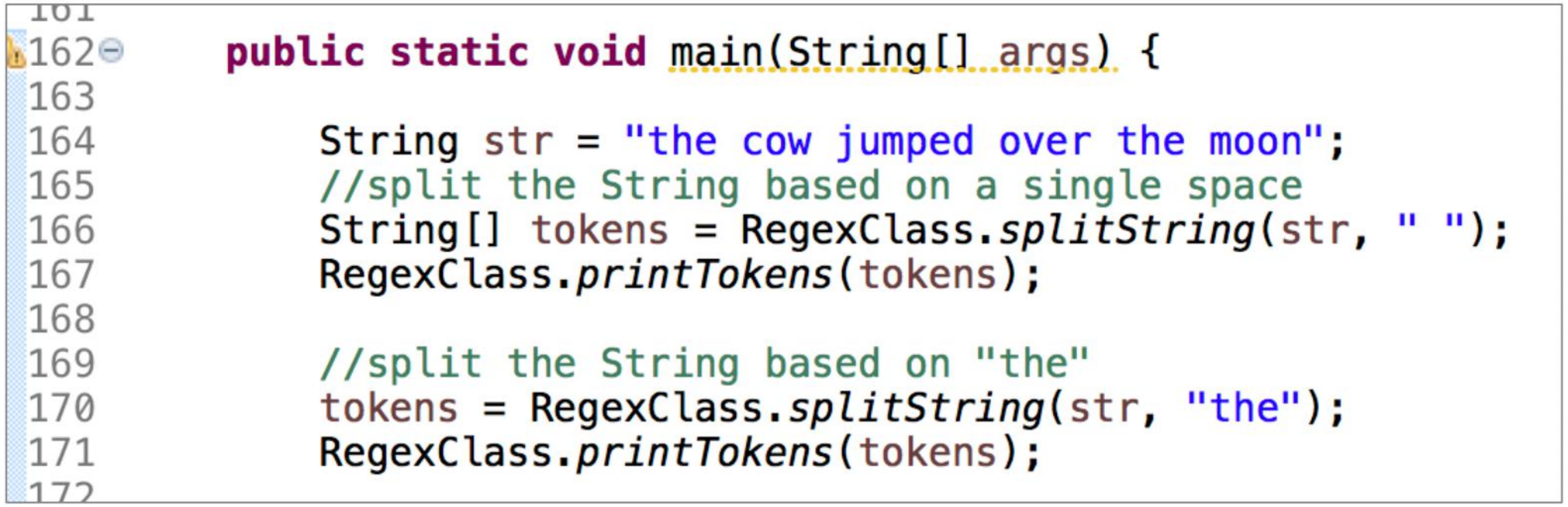
Regular Expressions

- A regular expression (or regex) is a special sequence of characters that describes a pattern used for searching, editing, and manipulating text and data
- For example, regular expressions are widely used to define the constraint on Strings in password and email validation

Split a String

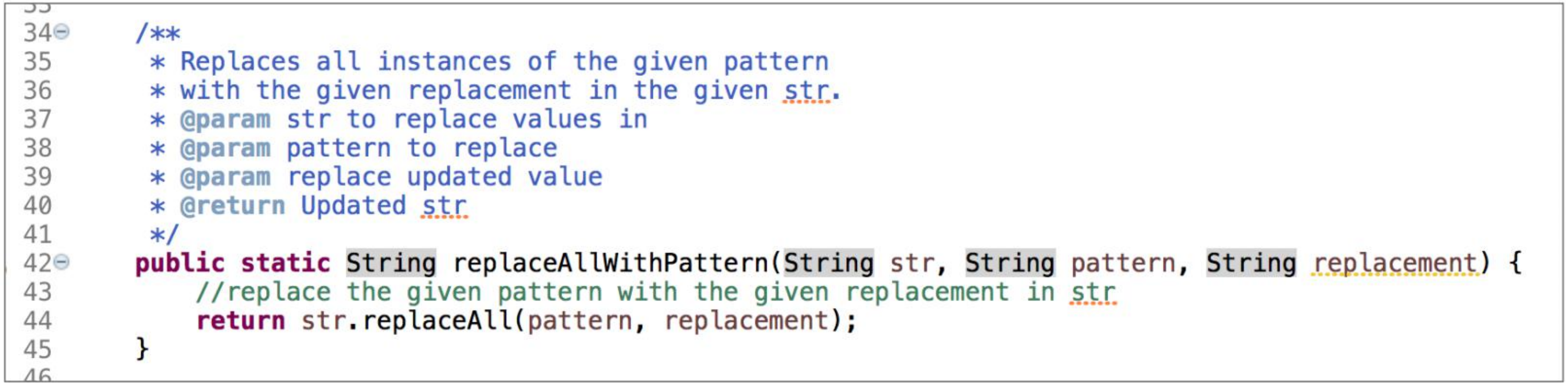


```
    /**
     * Splits given string based on given regex pattern.
     * @param str to split
     * @param regex to match
     * @return String array of tokens (Strings)
     */
    public static String[] splitString(String str, String regex) {
        //split the given string str based on the given regex
        return str.split(regex);
    }
```

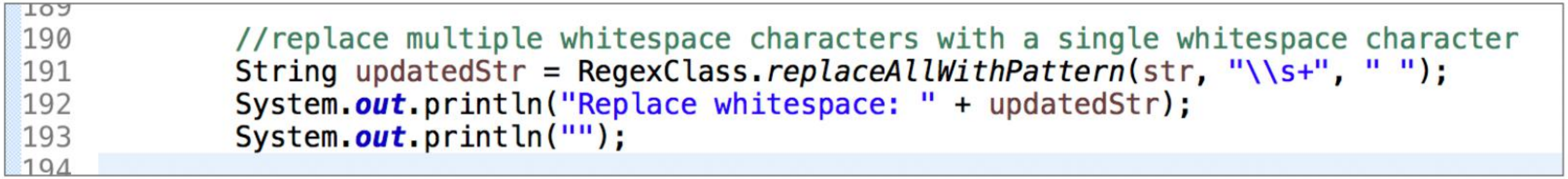


```
    public static void main(String[] args) {

        String str = "the cow jumped over the moon";
        //split the String based on a single space
        String[] tokens = RegexClass.splitString(str, " ");
        RegexClass.printTokens(tokens);

        //split the String based on "the"
        tokens = RegexClass.splitString(str, "the");
        RegexClass.printTokens(tokens);
```

Replace all with a pattern

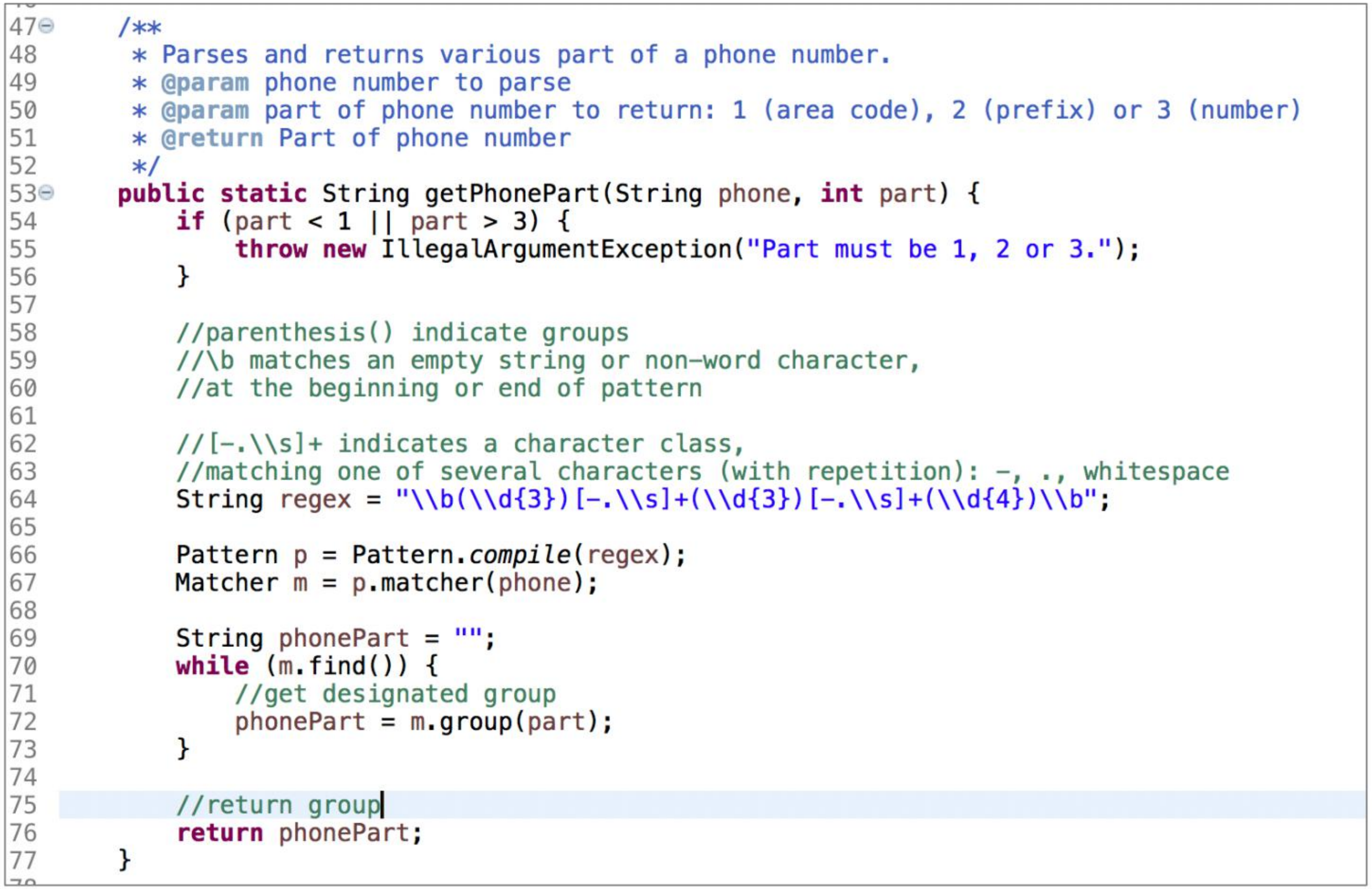


```java
    /**
     * Replaces all instances of the given pattern
     * with the given replacement in the given str.
     * @param str to replace values in
     * @param pattern to replace
     * @param replace updated value
     * @return Updated str
     */
    public static String replaceAllWithPattern(String str, String pattern, String replacement) {
        //replace the given pattern with the given replacement in str
        return str.replaceAll(pattern, replacement);
    }
```



```java
        //replace multiple whitespace characters with a single whitespace character
        String updatedStr = RegexClass.replaceAllWithPattern(str, "\\s+", " ");
        System.out.println("Replace whitespace: " + updatedStr);
        System.out.println("");
```

Get Parts of a Phone Number



```java
    /**
     * Parses and returns various part of a phone number.
     * @param phone number to parse
     * @param part of phone number to return: 1 (area code), 2 (prefix) or 3 (number)
     * @return Part of phone number
     */
    public static String getPhonePart(String phone, int part) {
        if (part < 1 || part > 3) {
            throw new IllegalArgumentException("Part must be 1, 2 or 3.");
        }

        //parenthesis() indicate groups
        //\b matches an empty string or non-word character,
        //at the beginning or end of pattern

        //[-.\\s]+ indicates a character class,
        //matching one of several characters (with repetition): -, ., whitespace
        String regex = "\\b(\\d{3})[-.\\s]+(\\d{3})[-.\\s]+(\\d{4})\\b";

        Pattern p = Pattern.compile(regex);
        Matcher m = p.matcher(phone);

        String phonePart = "";
        while (m.find()) {
            //get designated group
            phonePart = m.group(part);
        }

        //return group
        return phonePart;
    }
```