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Homework #3

Due: March 30th 2017

Question 1:

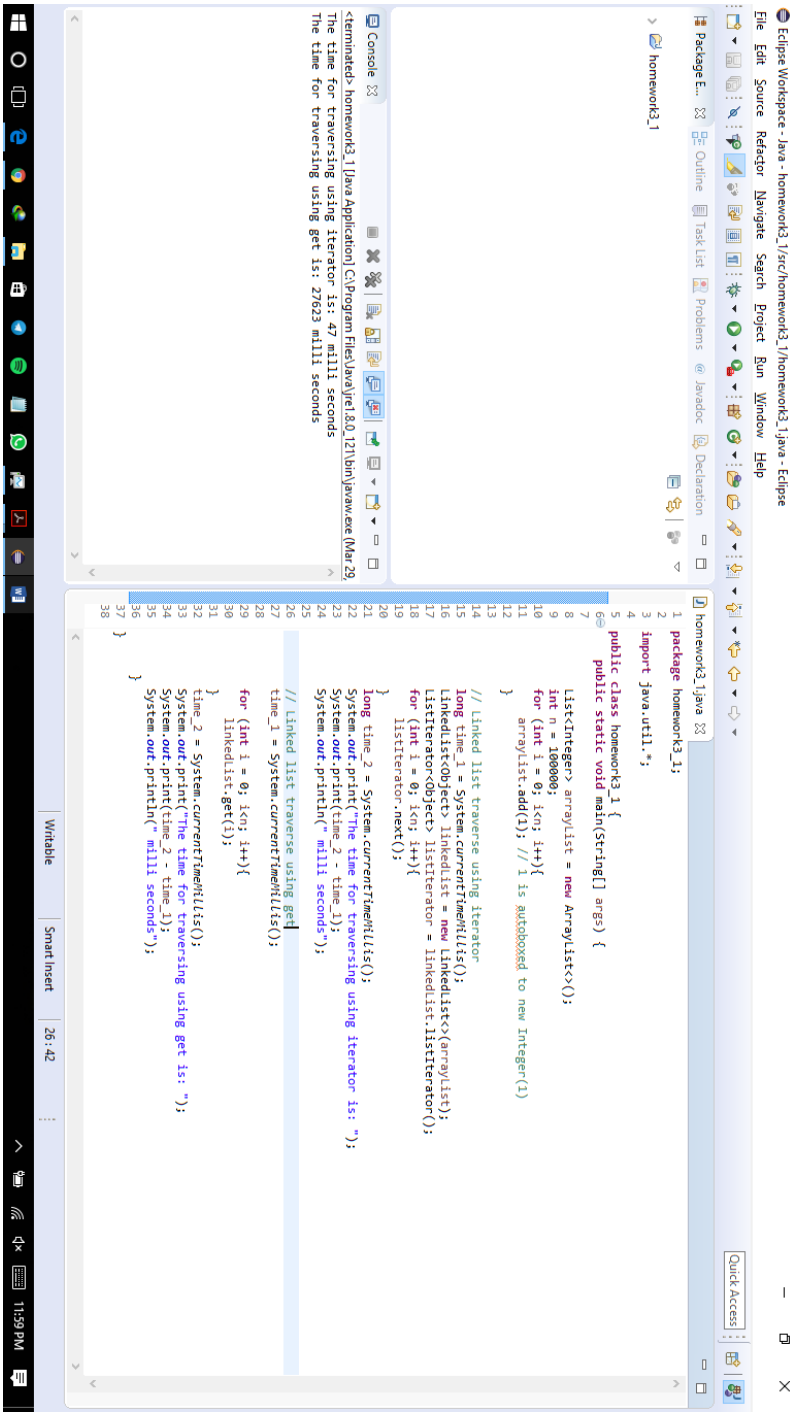
```
package homework3_1;

import java.util.*;

public class homework3_1 {
	public static void main(String[] args) {

		List<Integer> arrayList = new ArrayList<>();
		int n = 100000;
		for (int i = 0; i<n; i++){
			arrayList.add(1); // 1 is autoboxed to new Integer(1)
		}

		// Linked list traverse using iterator
		long time_1 = System.currentTimeMillis();
		LinkedList<Object> linkedList = new LinkedList<>(arrayList);
		ListIterator<Object> listIterator = linkedList.listIterator();
		for (int i = 0; i<n; i++){
		    listIterator.next();
		}
		long time_2 = System.currentTimeMillis();
		System.out.print("The time for traversing using iterator is: ");
		System.out.print(time_2 - time_1);
		System.out.println(" milli seconds");

		// Linked list traverse using get
		time_1 = System.currentTimeMillis();

		for (int i = 0; i<n; i++){
		  linkedList.get(i);
		}
		time_2 = System.currentTimeMillis();
		System.out.print("The time for traversing using get is: ");
		System.out.print(time_2 - time_1);
		System.out.println(" milli seconds");
	}
}
```

What this question is asking is about how long it takes to print all data of a linked list if we use iterator versus get. If I use iterator it starts from the first element and iterates to the end and prints all of that one by one. However, every single time I trigger get, it starts from the first element and iterates all the way to the target and only prints the target. In other words, as the input element of the get gets bigger, it takes more time to print all data.

The Following simulation is for 100,000 data since it took very long to simulate for 5,000,000 data.

Question 1 Output:

```
he time for traversing using iterator is: 47 milli seconds
The time for traversing using get is: 27623 milli seconds
```



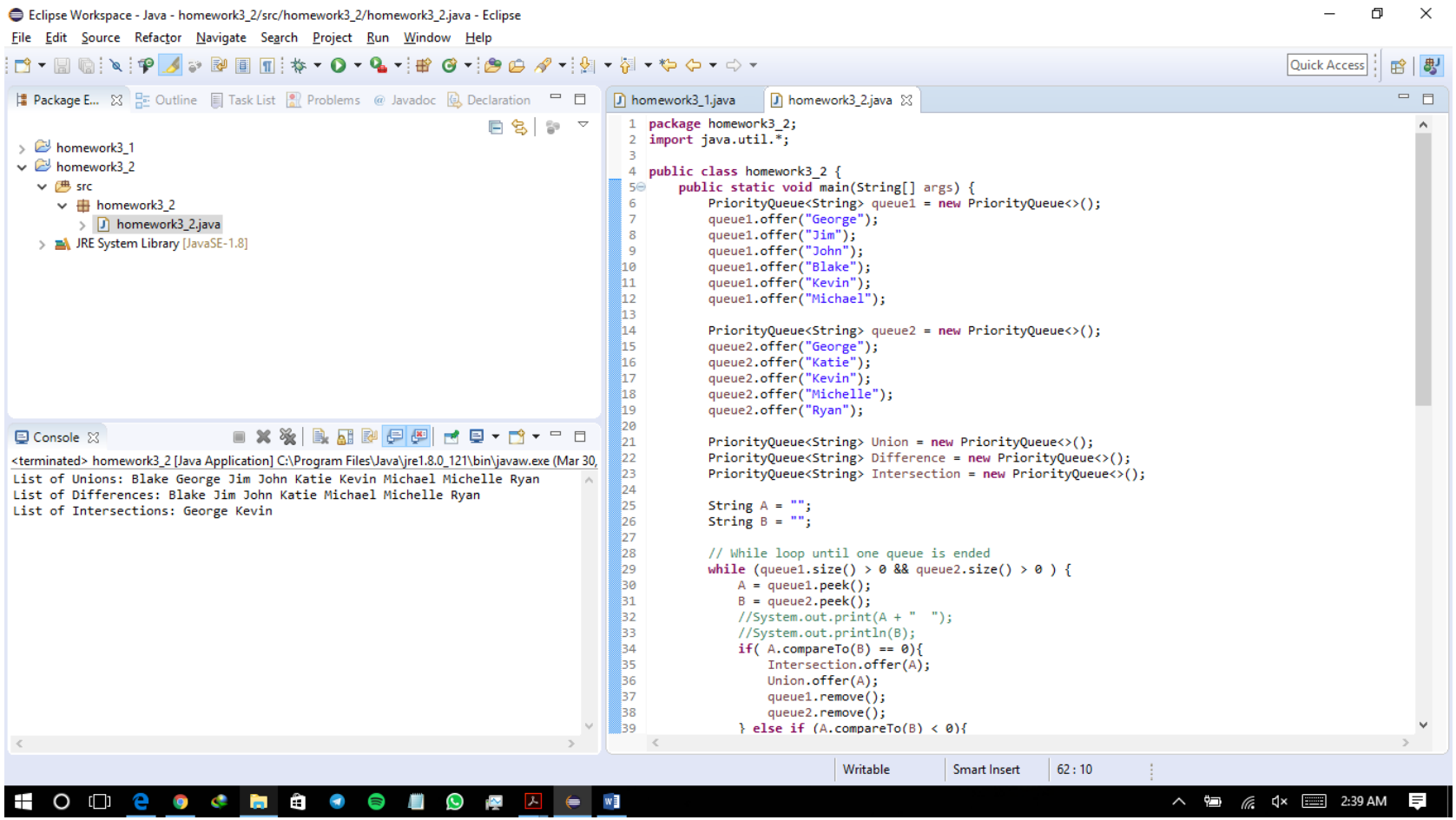
Question 2:

```
package homework3_2;
import java.util.*;

public class homework3_2 {
	public static void main(String[] args) {
	    PriorityQueue<String> queue1 = new PriorityQueue<>();
	    queue1.offer("George");
	    queue1.offer("Jim");
	    queue1.offer("John");
	    queue1.offer("Blake");
	    queue1.offer("Kevin");
	    queue1.offer("Michael");

	    PriorityQueue<String> queue2 = new PriorityQueue<>();
	    queue2.offer("George");
	    queue2.offer("Katie");
	    queue2.offer("Kevin");
	    queue2.offer("Michelle");
	    queue2.offer("Ryan");

	    PriorityQueue<String> Union = new PriorityQueue<>();
	    PriorityQueue<String> Difference = new PriorityQueue<>();
	    PriorityQueue<String> Intersection = new PriorityQueue<>();

	    String A = "";
	    String B = "";

	    // While loop until one queue is ended
	    while (queue1.size() > 0 && queue2.size() > 0 ) {
	        A = queue1.peek();
	        B = queue2.peek();
	        //System.out.print(A + "  ");
	        //System.out.println(B);
	        if( A.compareTo(B) == 0){
	             Intersection.offer(A);
	             Union.offer(A);
	             queue1.remove();
	              queue2.remove();
	        } else if (A.compareTo(B) < 0){
	             Union.offer(A);
	             Difference.offer(A);
	             queue1.remove();
	        } else {
	             Union.offer(B);
	             Difference.offer(B);
	             queue2.remove();
	        }
	    }

	    // While for the loop with remaining data
```

```
            while (queue1.size() > 0){
               A = queue1.remove();
               Union.offer(A);
               Difference.offer(A);
            }

            // While for the loop with remaining data
            while (queue2.size() > 0){
               B = queue2.remove();
               Union.offer(B);
               Difference.offer(B);
            }

            System.out.print("List of Unions: ");
          while (Union.size() > 0) {
              System.out.print(Union.remove() + " ");
          }
          System.out.println("");

        System.out.print("List of Differences: ");
          while (Difference.size() > 0) {
              System.out.print(Difference.remove() + " ");
          }
          System.out.println("");

          System.out.print("List of Intersections: ");
          while (Intersection.size() > 0) {
              System.out.print(Intersection.remove() + " ");
          }
          System.out.println("");
        }
}
```

Question 2 Output:

```
List of Unions: Blake George Jim John Katie Kevin Michael Michelle Ryan
List of Differences: Blake Jim John Katie Michael Michelle Ryan
List of Intersections: George Kevin
```

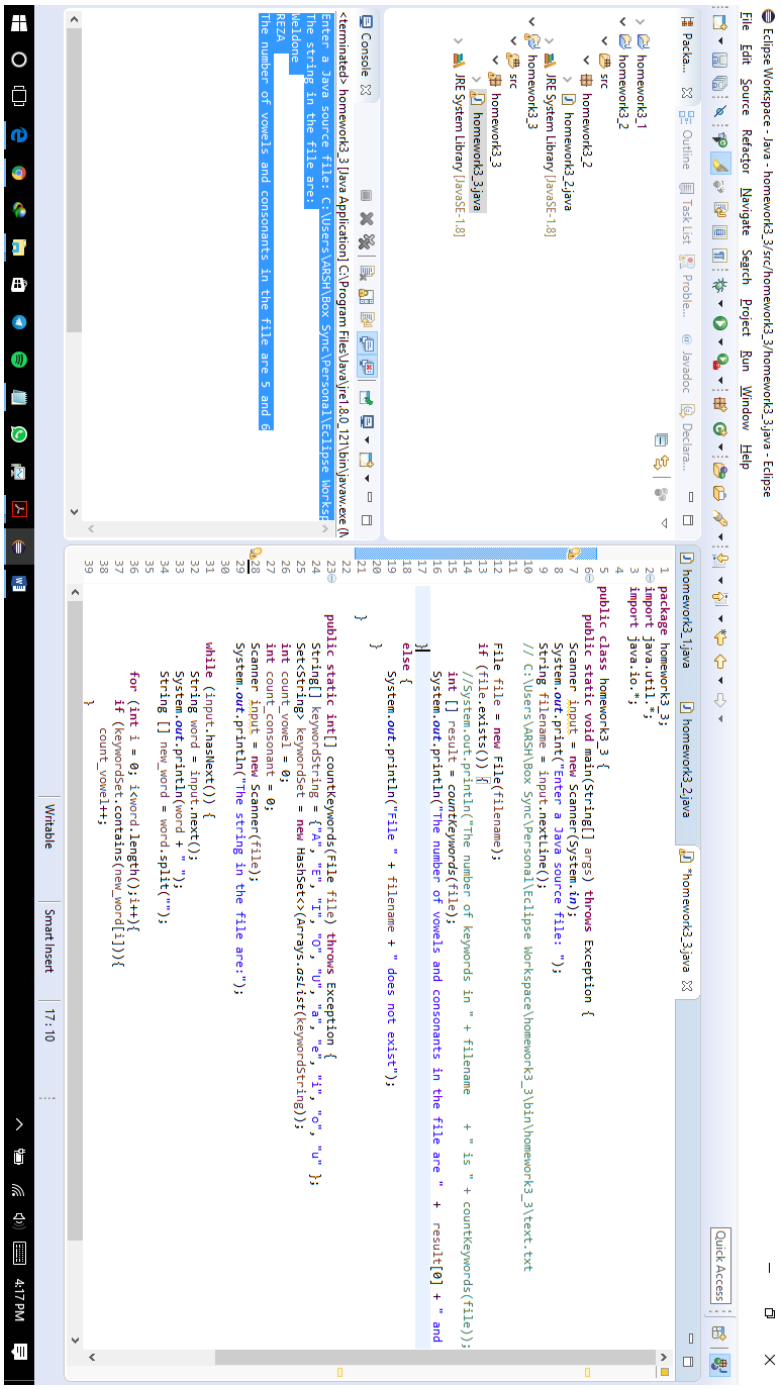

Eclipse Workspace - Java - homework3_2/src/homework3_2/homework3_2.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Package E... Outline Task List Problems Javadoc Declaration
homework3_1
homework3_2
src
homework3_2
homework3_2.java
JRE System Library [JavaSE-1.8]
homework3_1.java
homework3_2.java
1 package homework3_2;
2 import java.util.*;
3
4 public class homework3_2 {
5 public static void main(String[] args) {
6 PriorityQueue<String> queue1 = new PriorityQueue<>();
7 queue1.offer("George");
8 queue1.offer("Jim");
9 queue1.offer("John");
10 queue1.offer("Blake");
11 queue1.offer("Kevin");
12 queue1.offer("Michael");
13
14 PriorityQueue<String> queue2 = new PriorityQueue<>();
15 queue2.offer("George");
16 queue2.offer("Katie");
17 queue2.offer("Kevin");
18 queue2.offer("Michelle");
19 queue2.offer("Ryan");
20
21 PriorityQueue<String> Union = new PriorityQueue<>();
22 PriorityQueue<String> Difference = new PriorityQueue<>();
23 PriorityQueue<String> Intersection = new PriorityQueue<>();
24
25 String A = "";
26 String B = "";
27
28 // While loop until one queue is ended
29 while (queue1.size() > 0 && queue2.size() > 0) {
30 A = queue1.peek();
31 B = queue2.peek();
32 //System.out.print(A + " ");
33 //System.out.println(B);
34 if(A.compareTo(B) == 0){
35 Intersection.offer(A);
36 Union.offer(A);
37 queue1.remove();
38 queue2.remove();
39 } else if (A.compareTo(B) < 0){
Console
<terminated> homework3_2 [Java Application] C:\Program Files\Java\jre1.8.0_121\bin\javaw.exe (Mar 30,
List of Unions: Blake George Jim John Katie Kevin Michael Michelle Ryan
List of Differences: Blake Jim John Katie Michael Michelle Ryan
List of Intersections: George Kevin
Writable
Smart Insert
62 : 10
2:39 AM

Question 3:

```
package homework3_3;
import java.util.*;
import java.io.*;

public class homework3_3 {
	public static void main(String[] args) throws Exception {
		Scanner input = new Scanner(System.in);
		System.out.print("Enter a Java source file: ");
		String filename = input.nextLine();
		// C:\Users\ARSH\Box Sync\Personal\Eclipse
Workspace\homework3_3\bin\homework3_3\text.txt

		File file = new File(filename);
		if (file.exists()) {
			//System.out.println("The number of keywords in " + filename
	+ " is " + countKeywords(file));
			int [] result = countKeywords(file);
			System.out.println("The number of vowels and consonants in the
file are "  +  result[0] + " and "+ result[1] );
		}
		else {
			System.out.println("File " + filename + " does not exist");
		}
	}

	public static int[] countKeywords(File file) throws Exception {
		String[] keywordString = {"A", "E", "I", "O", "U", "a", "e", "i", "o",
"u" };
		Set<String> keywordSet = new HashSet<>(Arrays.asList(keywordString));
		int count_vowel = 0;
		int count_consonant = 0;
		Scanner input = new Scanner(file);
		System.out.println("The string in the file are:");

		while (input.hasNext()) {
			String word = input.next();
			System.out.println(word + " ");
			String [] new_word = word.split("");

			for (int i = 0; i<word.length();i++){
				if (keywordSet.contains(new_word[i])){
					count_vowel++;
				}
				else {
					count_consonant++;
				}
			}
		}
		int[] result = {count_vowel, count_consonant};
		return result;
	}
}
```

Question 3 Output:

```
Enter a Java source file: C:\Users\ARSH\Box Sync\Personal\Eclipse
Workspace\homework3_3\bin\homework3_3\text.txt
The string in the file are:
Weldone
REZA
The number of vowels and consonants in the file are 5 and 6
```

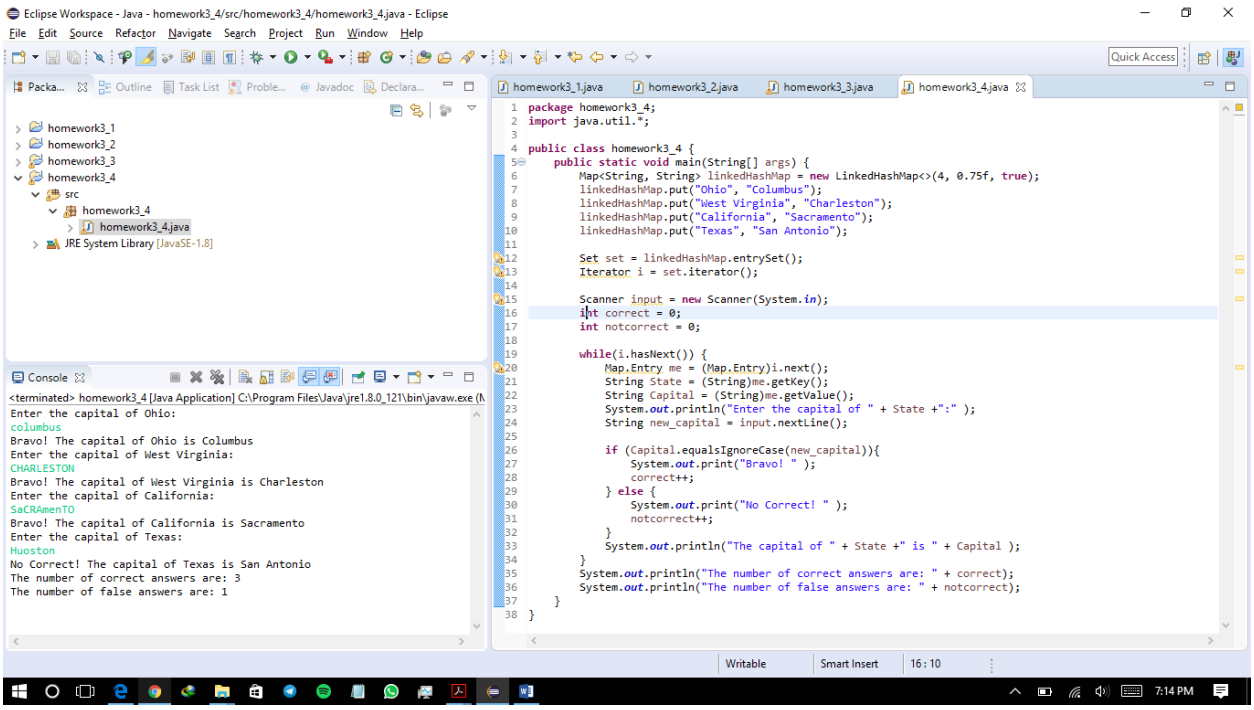


Question 4:

```
package homework3_4;
import java.util.*;

public class homework3_4 {
	public static void main(String[] args) {
		Map<String, String> linkedHashMap =    new LinkedHashMap<>(4, 0.75f,
true);
		linkedHashMap.put("Ohio", "Columbus");
		linkedHashMap.put("West Virginia", "Charleston");
		linkedHashMap.put("California", "Sacramento");
		linkedHashMap.put("Texas", "San Antonio");

		Set set = linkedHashMap.entrySet();
		Iterator i = set.iterator();

		Scanner input = new Scanner(System.in);
		int correct = 0;
		int notcorrect = 0;

		while(i.hasNext()) {
			Map.Entry me = (Map.Entry)i.next();
			String State = (String)me.getKey();
			String Capital = (String)me.getValue();
			System.out.println("Enter the capital of " + State +":" );
			String new_capital = input.nextLine();

			if (Capital.equalsIgnoreCase(new_capital)){
				System.out.print("Bravo! " );
				correct++;
			} else {
				System.out.print("No Correct! " );
				notcorrect++;
			}
			System.out.println("The capital of " + State +" is " + Capital );
		}
		System.out.println("The number of correct answers are: " + correct);
		System.out.println("The number of false answers are: " + notcorrect);
	}
}
```

Question 4 Output:

```
Enter the capital of Ohio:
columbus
Bravo! The capital of Ohio is Columbus
Enter the capital of West Virginia:
CHARLESTON
Bravo! The capital of West Virginia is Charleston
Enter the capital of California:
SaCRAmenTO
Bravo! The capital of California is Sacramento
Enter the capital of Texas:
Huoston
No Correct! The capital of Texas is San Antonio
The number of correct answers are: 3
The number of false answers are: 1
```



Question 5:

5.1. Greater Common Divisor (GCD) using Euclidean Method:

What is essential about the Euclid method is that it works recursively and invokes itself until it hits 1. Every time it takes the GCD of n and the remainder of "m%n" which happens "k" times.

The remainder of two number can't be greater than the half of the largest one which can be show as follows

10%1 = 0

10%2 = 0

10%3 = 1

10%4 = 2

10%5 = 0

10%6 = 4

10%7 = 3

10%8a = 2

10%9 = 1

which are all leass than n / 2 = 5.

Thus every time the "m%n" is invoked, the value gets halved.

gcd(m, n)
gcd(n, m % n)
gcd(m % n, n % (m % n))

as shown above every two iteration the first value gets halved thus the value of "k" should be $\frac{n}{2^{k/2}} \leq 1$, which is $k \geq 2 \log n$

Thus the time complexity is O(log *n*)

5.2. prime number using Sieve of Eratosthenes:

The Sieve of Eratosthenes's method eliminates the products of all numbers with itself in an increasing order to the end and counts the remaining unaffected number as prime numbers. If the number is n, the method gets invoked n/2 times for 2, n/3 times for 3 and so on, thus the complexity is:

O (n/2 + n/3 + n/5 + n/11 + …) = n * O (1/2 + 1/3 + 1/5 + 1/11 + …) ≤ O(nF(n)) = $O(\frac{n\sqrt{n}}{\log n})$