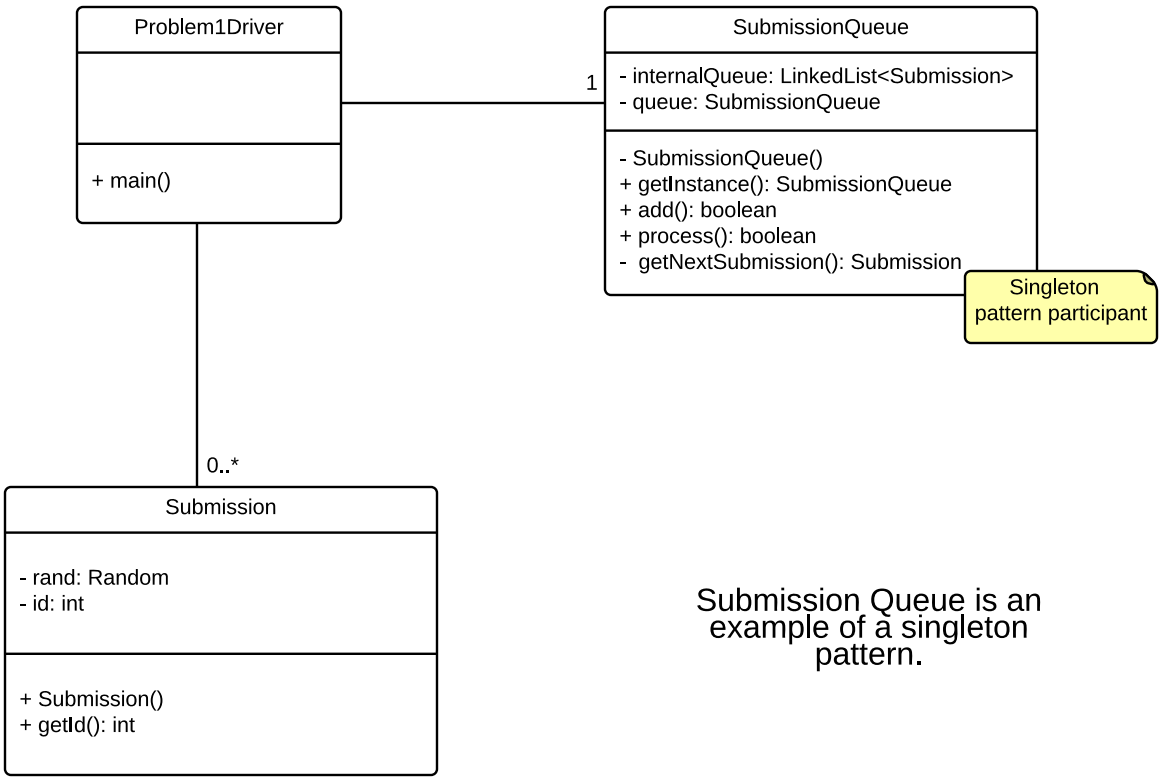
Team: John Luke Bucuvalas, Zack Doyle, Brandon Mikulka

Problem 1

This problem uses the singleton pattern. The ultimate goal is to ensure that there is only ever a single queue created for homework submissions. The singleton pattern accomplishes this. The submission looks for the queue, if there is one created, it retrieves the single instance of that queue, otherwise it creates a new queue. From here submissions may be added and processed using that queue.

[DIAGRAM ON NEXT PAGE]

Problem 1 Class Diagram



Submission Queue is an example of a singleton pattern.

Problem Work Breakdown:

Percent	Name	Work Done on this problem
25%	John Luke Bucuvalas	Looked over, discussed and approved, wrote writeup
35%	Zack Doyle	Began implementation, looked over and approved
40%	Brandon Mikulka	Commented, implemented design pattern, created diagram & pdf

Example Run

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_31.jdk/Contents/Home/bin/java ...
Creating new instance of SubmissionQueue
Adding Submission with id 1876432
Adding Submission with id 4935241
Adding Submission with id 9893949
Adding Submission with id 7252110
Processing Submission with id 1876432
Processing Submission with id 4935241
Using already instantiated Queue
Adding Submission with id 6214064
Adding Submission with id 5413291
Processing Submission with id 9893949
Processing Submission with id 7252110
Processing Submission with id 6214064
Processing Submission with id 5413291
```

Figure 1: Screenshot of output

Code:

```
public class Problem1Driver {
    public static void main(String[] args) {
        Submission submission1 = new Submission();
        Submission submission2 = new Submission();
        Submission submission3 = new Submission();
        Submission submission4 = new Submission();
        Submission submission5 = new Submission();
        Submission submission6 = new Submission();

        SubmissionQueue queue = SubmissionQueue.getInstance();

        queue.add(submission1);
        queue.add(submission2);
        queue.add(submission3);
        queue.add(submission4);
```

```
        queue.process();
        queue.process();

        SubmissionQueue queue2 = SubmissionQueue.getInstance();

        queue2.add(submission5);
        queue2.add(submission6);

        queue2.process();
        queue2.process();
        queue2.process();
        queue2.process();

    }
}


import java.util.Random;

public class Submission
{
    private static Random rand = new Random();
    private int id;

    public Submission()
    {
    // Give this submission a unique(ish) id
        id = rand.nextInt(10000000);
    }

    public int getId(){
        return id;
    }
}

import java.util.LinkedList;
import java.util.NoSuchElementException;

public class SubmissionQueue
{
  private LinkedList<Submission> internalQueue;
    private static SubmissionQueue queue;

    private SubmissionQueue(){
        internalQueue = new LinkedList<Submission>();
```

```
    }

    public static SubmissionQueue getInstance(){
        if (queue == null){
            System.out.println("Creating new instance of SubmissionQueue");
            queue = new SubmissionQueue();
        }
        else{
            System.out.println("Using already instantiated Queue");
        }
        return queue;
    }

  public synchronized boolean add(Submission submission){
    System.out.println("Adding Submission with id " + submission.getId());
        return internalQueue.add(submission);
  }

    public boolean process() {
        Submission target = getNextSubmission();
        if (target != null){
            System.out.println("Processing Submission with id " + target.getId());
            return true;
        }
        return false;
    }

    private synchronized Submission getNextSubmission(){
        Submission target;
        try {
            target = internalQueue.remove();
            return target;
        }
        catch(NoSuchElementException e){
            System.err.println("Caught NoSuchElementException: " + e.getMessage());
            return null;
        }
    }
}
```

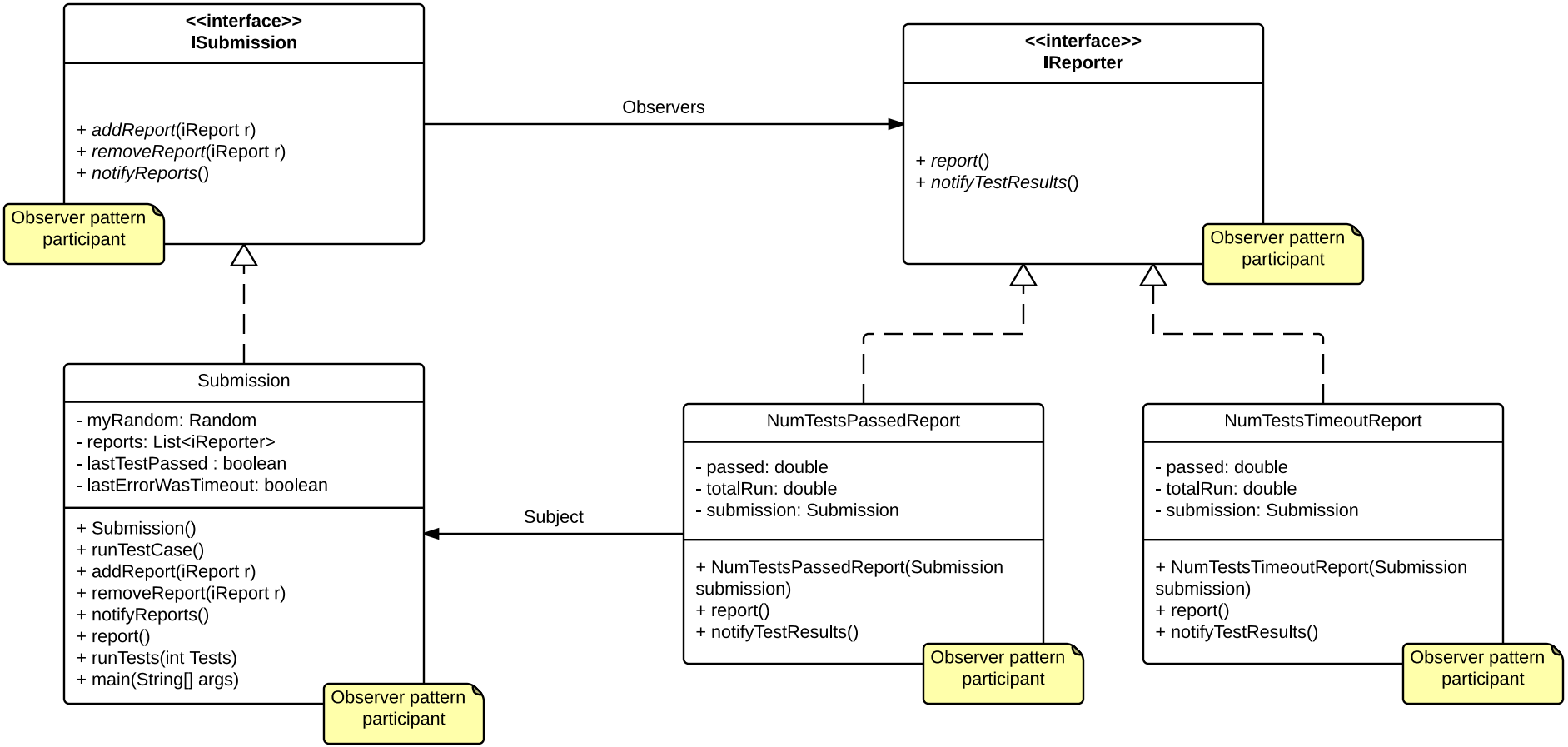
Problem 2

This problem uses the observer pattern. In this case, the reports observe the submission. The two reporter classes implement a reporter interface class

(iReporter), which ensures that any class that implements the interface contains the notifyTestResult() method. When a test case is run in the submission class, it sets whether the last test passed and whether the timeout failed. The submission then uses the interface's method to inform its report classes that a test has been run. The report classes have the knowledge in their notifyTestResult() method to correctly process the results of the test.

[DIAGRAM ON NEXT PAGE]

Problem 2 Class Diagram



This is an observer patttern with iSubmission bing the subject interface and iReporter being the observers interface. The implemented classes are the concrete subjects and reports.

Problem Work Breakdown:

Percent	Name	Work Done on this problem
50%	John Luke Bucuvalas	Implemented design pattern and did writeup
15%	Zack Doyle	Reviewed code and worked to help fix
35%	Brandon Mikulka	Worked to fix pattern, created diagram & pdf

Example Run

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_31.jdk/Contents/Home/bin/java ...
DEBUG: Report added to reports list
DEBUG: Report added to reports list
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Submission calling notifyReports()
DEBUG: Grabbing reports for display
DEBUG: method NumTestPassingReport report method called
**********************************
Submission Test Passed Report:
*** Tests Passed: 9.0
*** Total Run: 20.0
*** Submission Grade: 0.45
**********************************
DEBUG: method NumTestTimeoutReport report method called
**********************************
Test Timeout Report
*** Number of Timeouts: 4
*** Total failed: 11
**********************************
```

Figure 2: Screenshot of output

Code:

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

interface ISubmission{
    public abstract void addReport(iReporter r);
    public abstract void removeReport(iReporter r);
    public abstract void notifyReports();
}

public class Submission implements ISubmission
{
    private Random myRandom;
    private List<iReporter> reports;
    private boolean lastTestPassed;
  private boolean lastErrorWasTimeout;

    // You may add attributes to this class if necessary

  public Submission()
  {
      myRandom = new Random();
    lastErrorWasTimeout = false;
    reports = new ArrayList<iReporter>();
  }

    public void runTestCase()
  {
      // For now, randomly pass or fail, possibly due to a timeout
    boolean passed = myRandom.nextBoolean();
    lastTestPassed = passed;
    if(!passed)
    {
        lastErrorWasTimeout = myRandom.nextBoolean();
    }
        System.out.println("DEBUG: Submission calling notifyReports()");
        notifyReports();
  }

    public boolean wasTimeoutError()
  {
      return lastErrorWasTimeout;
  }
  public boolean didTestPass()
```

```
{
  return lastTestPassed;
}

  @Override
  public void addReport(iReporter r){
      System.out.println("DEBUG: Report added to reports list");
      reports.add(r);

}
  @Override
  public void removeReport(iReporter r){
      int i = reports.indexOf(r);
      if (i >= 0) {
          reports.remove(i);
      }
  }

  @Override
public void notifyReports(){
  for (iReporter i : reports){
    i.notifyTestResult();
  }
}

public void report(){
      System.out.println("DEBUG: Grabbing reports for display");
      for (iReporter i : reports){
    i.report();
  }
}

public void runTests(){
  runTests(20);
}

public void runTests(int numTests){
  for (int i = 0; i < numTests; i++){
    runTestCase();
  }
}

public static void main(String[] args){
  Submission testSubmission = new Submission();
      new NumTestsPassedReport(testSubmission);
      new NumTestsTimeoutReport(testSubmission);
```

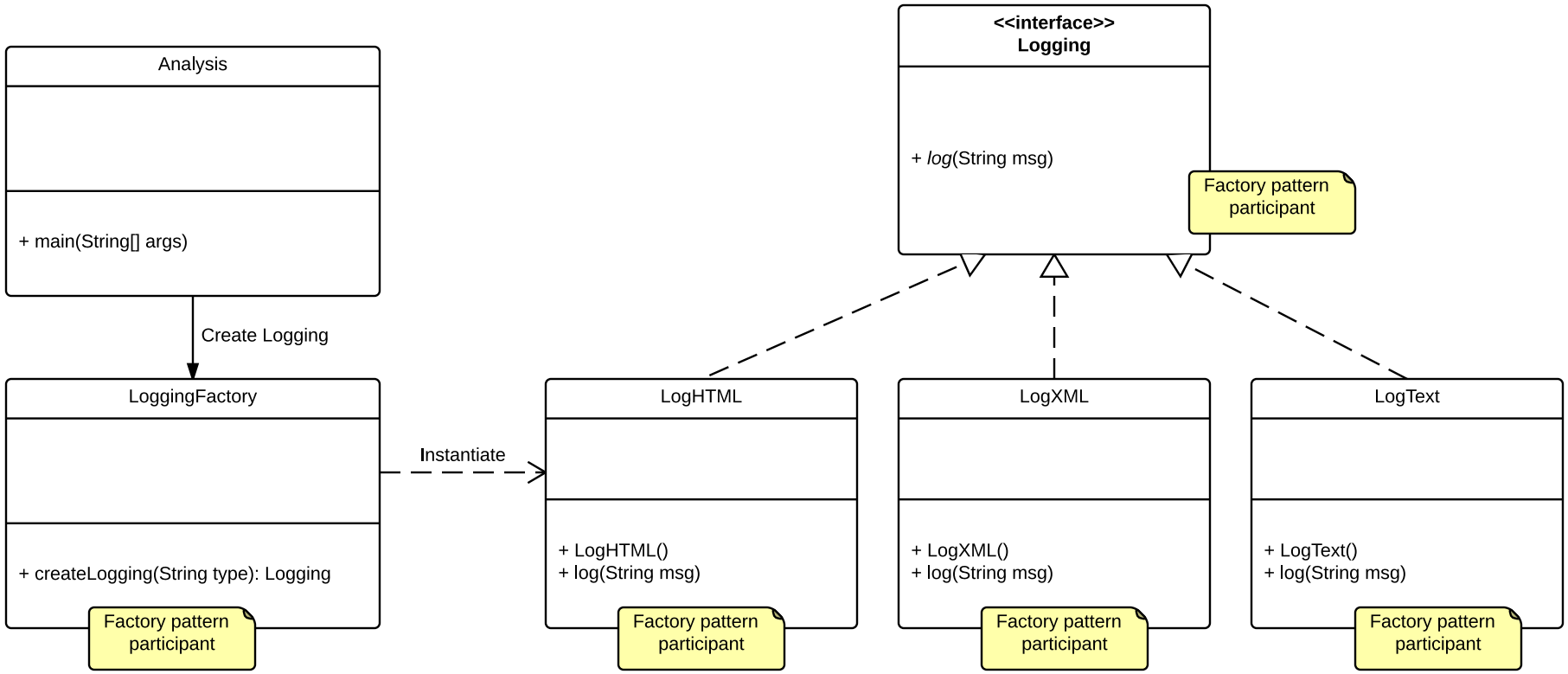
```
    testSubmission.runTests();
    testSubmission.report();
  }
}



interface iReporter
{

  public abstract void report();
  public abstract void notifyTestResult();
}


class NumTestsPassedReport implements iReporter
{
  private double passed;
  private double totalRun;
  private Submission submission;

  NumTestsPassedReport(Submission submission){
    passed = 0;
    totalRun = 0;
    this.submission = submission;
        this.submission.addReport(this);
  }

  public void report(){
        System.out.println("DEBUG: method NumTestPassingReport report method called");
        System.out.println("*********************************");
    System.out.println("Submission Test Passed Report: ");
    System.out.println("*** Tests Passed: " + passed);
    System.out.println("*** Total Run: " + totalRun);
    double grade = passed/totalRun;
    System.out.println("*** Submission Grade: " + grade);
    System.out.println("*********************************");
  }

    // Observer Update
  public void notifyTestResult(){
    boolean lp = submission.didTestPass();
    if (lp) passed ++;
    totalRun ++;
```

```
    }
}

class NumTestsTimeoutReport implements iReporter
{
  private int timedOut;
  private int numFailed;
  private Submission submission;

  public NumTestsTimeoutReport(Submission submission){
    timedOut = 0;
    numFailed = 0;
    this.submission = submission;
        this.submission.addReport(this);
  }
  public void report(){
        System.out.println("DEBUG: method NumTestTimeoutReport report method called");
    System.out.println("***********************************");
    System.out.println("Test Timeout Report");
    System.out.println("*** Number of Timeouts: " + timedOut);
    System.out.println("*** Total failed: " + numFailed);
    System.out.println("***********************************");
  }

    // Observer Update
  public void notifyTestResult(){
    boolean lt = submission.wasTimeoutError();
    boolean lp = submission.didTestPass();
    if (!lp){
      numFailed ++;
      if (lt){
        timedOut ++;
      }
    }
  }
}
```

Problem 3

This problem uses the factory pattern. Originally the driver contained a multiline if-statement to create the proper sort of logger. This if-statement would need to be repeated wherever the client might want to create a logger. Instead, the factory takes the wanted type of logger in and returns the proper new logger. This makes the client-side implementation much simpler.

Problem 3 Class Diagram



LoggingFactory is the factory part of the factory pattern and the different logs are the concrete products. The interface in this case acts as the abstract product since we did not have common code within the log methods.

Problem Work Breakdown:

Percent	Name	Work Done on this problem
60%	John Luke Bucuvalas	Implemented design pattern and did writeup
5%	Zack Doyle	Reviewed code
25%	Brandon Mikulka	Reviewed code, created diagram & pdf

Example Run

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_31.jdk/Contents/Home/bin/java ...
Factory creating 'Logging' of type = [xml]
Logging: <type>XML Format</type>
Logging xml to file: log.xml
<xml><msg>Starting application...</msg></xml>
Logging xml to file: log.xml
<xml><msg>... read in data file to analyze ...</msg></xml>
Logging xml to file: log.xml
<xml><msg>... Clustering data for analysis ...</msg></xml>
Logging xml to file: log.xml
<xml><msg>... Printing analysis results ...</msg></xml>
```

Figure 3: Screenshot of output

Code:

```
interface Logging
{
  public void log(String msg);
}

class LogText implements Logging
{
  public LogText()
  {
    System.out.println("Logging: text format");
  }
  public void log(String msg)
  {
    System.out.println("Logging text to file: " + msg);
  }
}
class LogXML implements Logging
{
  public LogXML()
```

```
  {
    System.out.println("Logging: <type>XML Format</type>");
  }
  public void log(String msg)
  {
    System.out.println("Logging xml to file: log.xml" );
    System.out.println("<xml><msg>"+msg+"</msg></xml>");
  }
}
class LogHTML implements Logging
{
  public LogHTML()
  {
    System.out.println("Logging: HTML format");
  }
  public void log(String msg)
  {
    System.out.println("Logging HTML to file: log.html" );
    System.out.println("<html><body>"+msg+"</body></html>");
  }
}

class LoggingFactory
{
  public static Logging createLogging(String type){
        System.out.println("Factory creating 'Logging' of type = [" + type + "]");
        if (type.equalsIgnoreCase("text"))
      return new LogText();
    else if (type.equalsIgnoreCase("xml"))
      return new LogXML();
    else if (type.equalsIgnoreCase("html"))
      return new LogHTML();
    else
      return new LogText();
  }

}

class Analysis
{
  public static void main(String[] args)
  {
    if (args.length != 1)
    {
      System.out.println("Usage: java Analysis type");
      System.exit(-1);
```

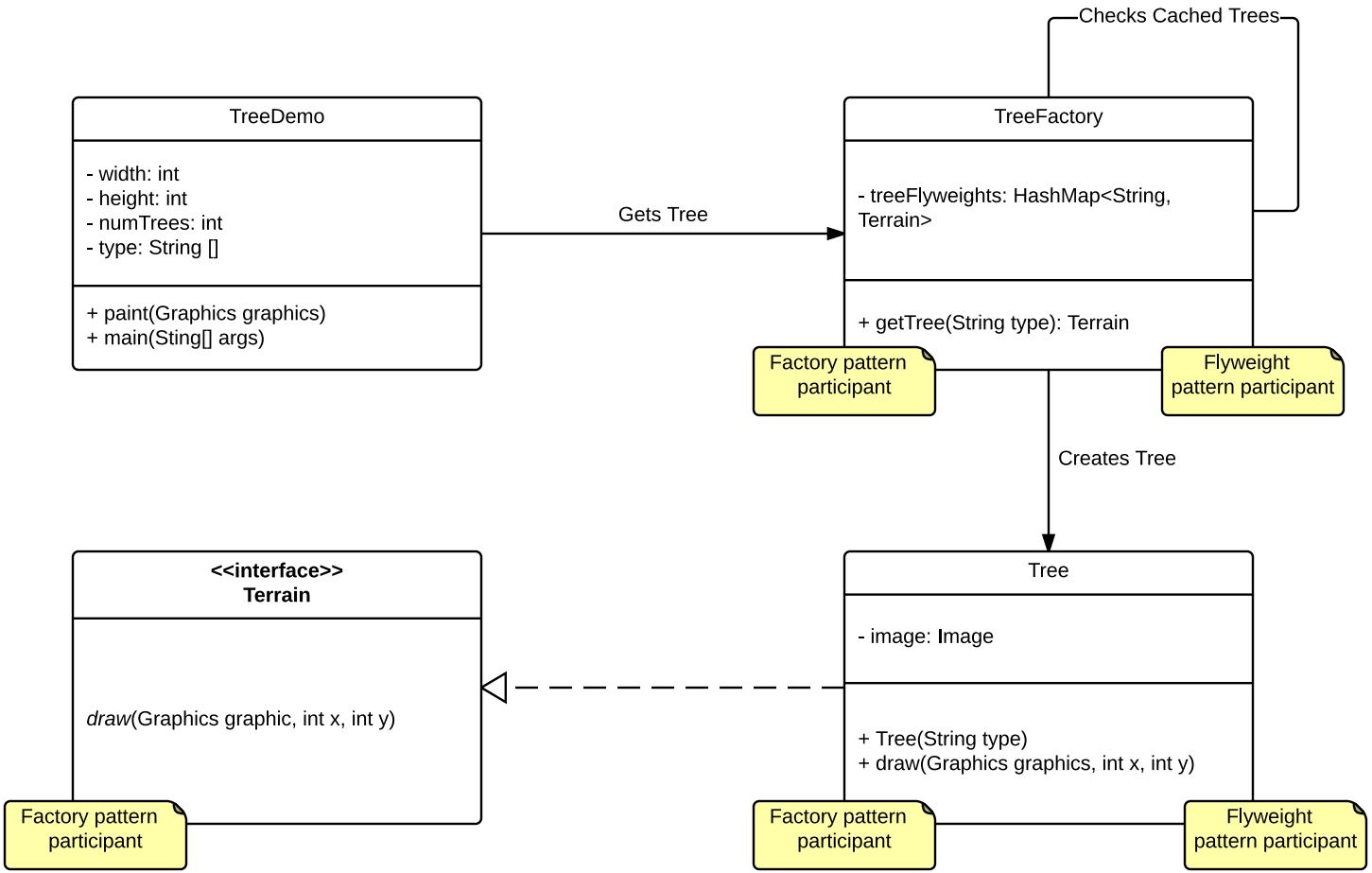
```
    }
    String type = args[0];
    Logging logfile = LoggingFactory.createLogging(type);
    logfile.log("Starting application...");

    logfile.log("... read in data file to analyze ...");
    // code...
    logfile.log("... Clustering data for analysis ...");
    // code...
    logfile.log("... Printing analysis results ...");
    // code...
  }
}
```

Problem 4

This problem uses the flyweight pattern. When a certain type of tree is requested, if that tree does not already exist, then the image is read from the file. However, if the tree does exist the image is drawn from the already existing map of images. This means that each image is only read in once, a much lighter way of drawing thousands of trees.

[DIAGRAM ON NEXT PAGE]

Problem 4 Class Diagram



TreeFactory, Tree, and Terrain are all members of the the Factory Pattern and act as Factory, Concrete Product, and Abstract Product, respectively. TreeFactory and Tree also are part of the flyweight pattern, with TreeFactory(flyweightfactory) caching Tree(flyweight) objects.

Problem Work Breakdown:

Percent	Name	Work Done on this problem
35%	John Luke Bucuvalas	Reviewed Code, helped fix, and did writeup
5%	Zack Doyle	Reviewed code
60%	Brandon Mikulka	Implemented design pattern, created diagram & pdf

Example Run (on next page)

Code:

```
import java.util.*;
import java.io.*;
import java.awt.*;
import javax.swing.*;
import javax.imageio.*;

interface Terrain
{
  void draw(Graphics graphics, int x, int y);
}
class Tree implements Terrain {
    private Image image;

    public Tree(String type) {
        System.out.println("Creating a new instance of a tree of type " + type);
        String filename = "tree" + type + ".png";
        try {
            image = ImageIO.read(new File(filename));
        } catch (Exception exc) {
            System.out.println("Could not read filename " + filename);
        }
    }

    @Override
    public void draw(Graphics graphics, int x, int y) {
        graphics.drawImage(image, x, y, null);
    }
}
class TreeFactory
{
  private static final Map<String, Terrain> treeFlyweights = new HashMap<String,Terrain>();
  public static Terrain getTree(String type)
    {
```

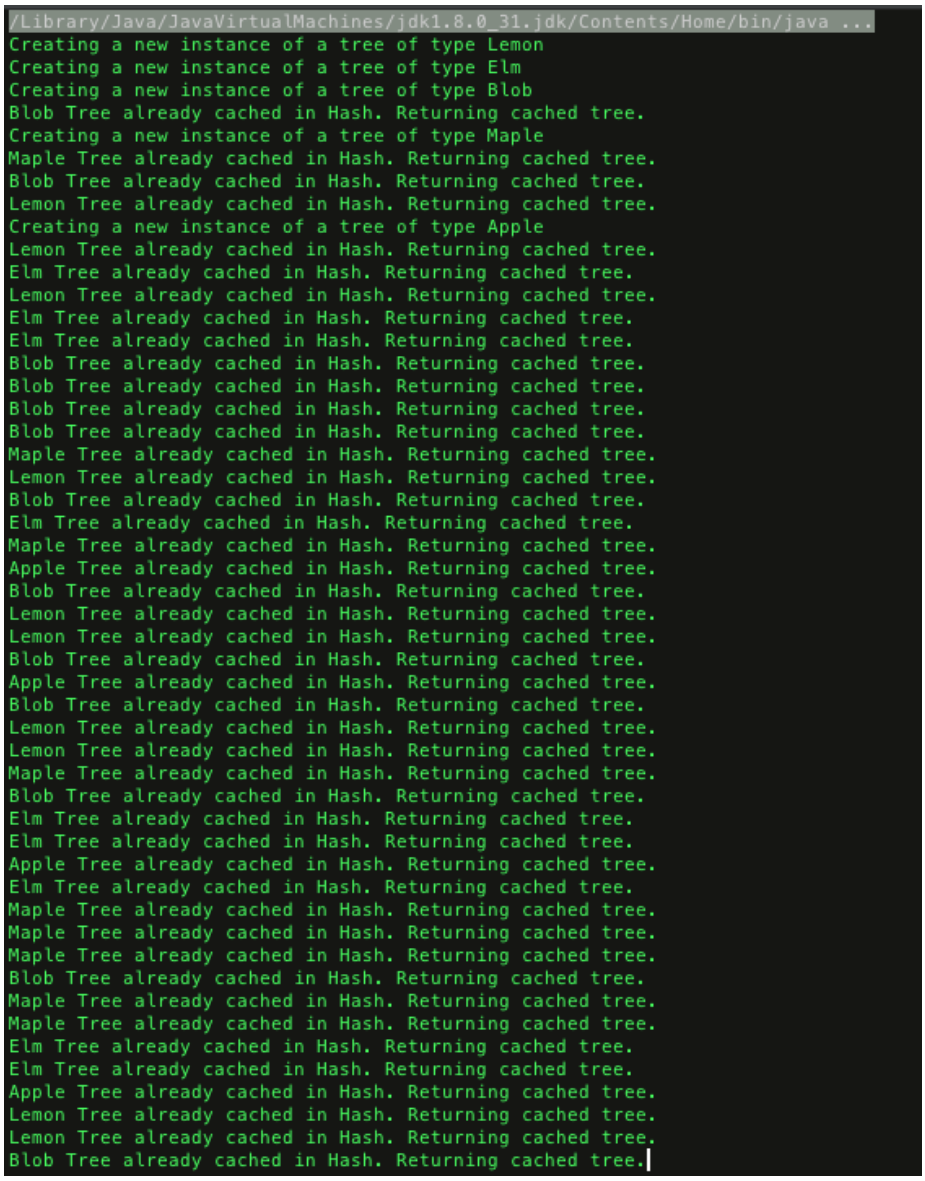


Figure 4: Screenshot of output

```
        //Implement Factory Design Pattern
        Terrain terrain = treeFlyweights.get(type);

        if (terrain == null){
            terrain = new Tree(type);
            treeFlyweights.put(type, terrain);
        }
        else{
            System.out.println(type + " Tree already cached in Hash. Returning cached tree.'
        }

        return terrain;
    }
}
/**
 * Don't change anything in TreeDemo
 */
class TreeDemo extends JPanel
{
  private static final int width = 800;
  private static final int height = 700;
  private static final int numTrees = 50;
  private static final String type[] = { "Apple", "Lemon", "Blob", "Elm", "Maple" };

  public void paint(Graphics graphics)
  {
    for(int i=0; i < numTrees; i++)
    {
      Tree tree = (Tree)TreeFactory.getTree(getRandomType());
      tree.draw(graphics, getRandomX(width), getRandomY(height));
    }
  }
  public static void main(String[] args)
  {
    JFrame frame = new JFrame();
    frame.add(new TreeDemo());
    frame.setSize(width, height);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
  }
  private static String getRandomType()
  {
    return type[(int)(Math.random()*type.length)];
  }
  private static int getRandomX(int max)
  {
```

```
    return (int)(Math.random()*max );
  }
  private static int getRandomY(int max)
  {
    return (int)(Math.random()*max);
  }
}
```