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|  | **University of Maryland College Park** |
| **Dept of Computer Science** |
| **CMSC132 Spring 2013** |
| **Midterm I Key** |

First Name (PRINT): **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Last Name (PRINT): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Lab TA (Circle One):**

**Adil (0101, 11am), Adil (0102, 12) Beth (0103, 2pm), Beth (Honors, 1pm)**

**Souvik (0201, 2pm), Souvik (0202, 12pm)**

I pledge on my honor that I have not given or received any unauthorized assistance on this examination.

Your signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Instructions**

* This exam is a closed-book and closed-notes exam.
* Total point value is 200 pts (220 pts for the honor’s section).
* The exam is a 50 minutes exam.
* Please use a pencil to complete the exam.
* **WRITE NEATLY**.
* You will receive 1 pt (extra credit) if you write at the top of this page “Testudo Rocks”. That will let us know you have read these instructions.

**Grader Use Only**

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| #1 | Java Language Features | (50) |  |
| #2 | Arrays | (50) |  |
| #3 | Class Implementation | (100) |  |
| #4 | Honors | (20) |  |
| **Total** | Total | (200/220) |  |

**Problem 1 (50 pts) Java Language Features**

1. (3 pts) The word that best describes what a constructor method does is:
	1. Heap space allocator
	2. Destructor
	3. Initializer**√**
	4. Garbage collector
2. (3 pts) A static initialization block is executed:
	1. When the class is loaded. **√**
	2. When an object of the class is created. **Note: we will accept this one as valid answer**
	3. When two or more constructors are executed.
	4. When the class does not define any non-static initialization block.
	5. None of the above.
3. (3 pts) We can override a final method:
	1. Always
	2. Only if defined in an abstract class.
	3. If it is a static method.
	4. Never**√**
	5. None of the above.
4. (3 pts) An abstract class:
	1. Can implement an interface. **√**
	2. Cannot define instance variables.
	3. a. and b.
	4. None of the above
5. (3 pts) A class extending an abstract class will become:
	1. Abstract if abstract method(s) from the super class are not defined in the subclass. **√**
	2. Non-Abstract no matter what we do.
	3. A Java collection.
	4. None of the above.
6. (3 pts) The class **Dessert** is an abstract class with a default constructor. Which of the following are VALID:
	1. Dessert a = null;
	2. Dessert b[10];
	3. Dessert c = new Dessert();
	4. a. and b. √
	5. b. and c.
	6. None of the above.
7. (3 pts) 55% code coverage implies:
	1. 45% of the code is incorrect.
	2. 55% of the code is correct.
	3. 45% of the code was executed by tests provided.
	4. None of the above. √
8. (3 pts) A finally block is executed:
	1. Only when an exception occurs.
	2. When the exception is a checked exception.
	3. When the exception is an unchecked exception.
	4. None of the above. √
9. (12 pts) Given the classes below, indicate whether the assignments are valid or invalid. Notice that we are using two packages.

**package toyPackage;**

**public class Toy {**

 **protected int size;**

 **static int *max*;**

 **public static final int *temp* = 10;**

**}**

**package experiment;**

**import toyPackage.\*;**

**public class Driver {**

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

 **Toy p = new Toy();**

 **p.size = 10; /\* Invalid \*/**

 **p.max = 20; /\* Invalid \*/**

 **Toy.max = 30; /\* Invalid \*/**

 **Toy.*temp* = 40; /\* Invalid \*/**

 **}**

**}**

1. (6 pts) A program reads a web address and tries to connect to the site. What kind of exception (check or uncheck) do you believe we should use when an invalid web address is provided? **Briefly** explain.

**Answer:** checked, as a program should do something about this situation

1. (8 pts) Provide a **brief** description (no code is necessary) of the employee example discussed in lecture that illustrated why we prefer composition over inheritance.

**Answer:** There were two kinds of employee: salaried and hourly. Using composition made it easier to change pay scales.

**Problem 2 (50 pts) Arrays**

Implement a method that rotates to the left the first element of the array associated with index **rowIndex**. For example, the following code fragment:

**int[][] testData = {{10, 20, 30}, {40, 50, 60}, {3, 6, 9}};**

***rotateLeftOnceRowWithIndex*(testData, 1);**

will update testData with the values **{{10, 20, 30}, {50, 60, 40}, {3, 6, 9}}**

The exception **IllegalArgumentException** will be thrown if the data parameter is null. The exception should use the message “Wrong value”. Notice that the **data** parameter is a **two-dimensional** array.

**public static void rotateLeftOnceRowWithIndex(int[][] data, int rowIndex) {**

**Answer:**

 **public static void rotateLeftOnceRowWithIndex(int[][] data, int rowIndex) {**

 **if (data == null) {**

 **throw new IllegalArgumentException("Wrong value in rotateLeftOnce");**

 **}**

 **int[] targetRow = data[rowIndex];**

 **int leftEntry = targetRow[0];**

 **for (int idx = 0; idx < targetRow.length - 1; idx++) {**

 **targetRow[idx] = targetRow[idx + 1];**

 **}**

 **targetRow[targetRow.length - 1] = leftEntry;**

 **}**

**Problem 3 (100 pts) Class Implementation**

For this problem you will complete a class named **StoreItem**. An **StoreItem** object has a name, a type (either Perishable or NonPerishable), and expiration month (expMon) and expiration week (expWeek). For example, an item that expires during the second week of May will have a expMon value of 5 and expWeek value of 2.

**public class StoreItem {**

 **private String name;**

 **private FoodType type;**

 **private int expMon, expWeek;**

 **public String getName() { return name; }**

 **public String toString() {**

 **return "(" + name + "," + type + "," + expMon + "," + expWeek + ")";**

 **}**

 **public StoreItem(String name, FoodType type, int expMon, int expWeek) {**

 **this.name = name;**

 **this.type = type;**

 **this.expMon = expMon;**

 **this.expWeek = expWeek;**

 **}**

**}**

For this problem:

1. All the methods are public and non-static. You do not need to copy the partially defined class we provided and then add the methods; just define the methods.
2. Define an enumerated type called **FoodType**. Define this type outside of the **StoreItem** class.
3. Define a **default constructor** that initializes the object using values ”NoName”, NonPerishable, 1 and 1.
4. Define an **equals** method that relies on instanceof and not on getClass(). Two **StoreItem** objects are considered equal if they have the same name.
5. The **StoreItem** class will implement the **Comparable** interface. The method associated with the interface will allow us to sort **StoreItem** objects based on expiration date ( items with early expiration dates will appear first). Remember to modify the **StoreItem** class definition we provided above so it implements this interface.
6. Define a class called **NameComparator** that allow us to compare two **StoreItem** objects based on their name. If we were to sort a list using this comparator, **StoreItem** objects will appear in increasing alphabetical order.
7. The sample driver (and output) below can help you verify the functionality of some of the methods described above. **Feel free to ignore this driver if you know what to implement.**

**Sample Driver**

 **ArrayList<StoreItem> items = new ArrayList<StoreItem>();**

 **items.add(new StoreItem("Milk", FoodType.*Perishable*, 2, 4));**

 **items.add(new StoreItem("Cookies", FoodType.*NonPerishable*, 1, 3));**

 **items.add(new StoreItem("Apples", FoodType.*Perishable*, 10, 1));**

 **Collections.*sort*(items);**

 **System.*out*.println("After first sort: " + items);**

 **Collections.*sort*(items, new NameComparator());**

 **System.*out*.println("After second sort: " + items);**

**Sample Driver Output**

**After first sort: [(Cookies,NonPerishable,1,3), (Milk,Perishable,2,4), (Apples,Perishable,10,1)]**

**After second sort: [(Apples,Perishable,10,1), (Cookies,NonPerishable,1,3), (Milk,Perishable,2,4)]**

Answer/Grading:

1. (10 pts) FoodType declaration

**public enum FoodType { Perishable, NonPerishable };**

1. (14 pts) Default Constructor

**public StoreItem() {**

 **this("NoName", FoodType.NonPerishable, 1, 1);**

 **}**

1. (26 pts) equals

 **public boolean equals(Object obj) {**

 **if (this == obj) {**

 **return true;**

 **}**

 **if (!(obj instanceof StoreItem)) {**

 **return false;**

 **}**

 **StoreItem i = (StoreItem) obj;**

 **return name.equals(i.name);**

 **}**

1. (28 pts) Comparable

 **public int compareTo(StoreItem i) {**

 **int monthDif = expMon - i.expMon;**

 **if (monthDif != 0) {**

 **return monthDif;**

 **}**

 **return expWeek - i.expWeek;**

 **}**

1. (22 pts) NameComparator

**public class NameComparator implements Comparator<StoreItem> {**

 **public int compare(StoreItem i1, StoreItem i2) {**

 **return i1.getName().compareTo(i2.getName());**

 **}**

**}**

**Problem 4 (20 pts) Honor’s Section Only**

**Notice: Only students in the honor’s section will receive credit for this problem.**

The **DBConnection** is a class that provides a Database connection. Complete the class implementation according to the following requirements:

1. We can only create objects of the **DBConnection** class using the **getDBConnection** method. Drivers that use this class may not create objects using new (any attempt will generate a compilation error).
2. Only a maximum of two **DBConnection** objects can be created. Once the second object has been created, a third call to **getDBConnection** will return **null** and no object will be created.
3. Feel free to add/modify the partially defined class provided below.
4. The following driver (that you can ignore if you know what to implement) illustrates how we can use this class.

**Sample Driver**

**public class Driver {**

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

 **DBConnection c = DBConnection.*getDBConnection*("UMDStaff");**

 **System.*out*.println(c.getName());**

 **c = DBConnection.*getDBConnection*("UMDStudents");**

 **System.*out*.println(c.getName());**

 **c = DBConnection.*getDBConnection*("UMDFaculty");**

 **System.*out*.println(c);**

 **}**

**}**

**Answer:**

 **public static DBConnection getDBConnection(String name) {**

 **if (total < 2) {**

 **total++;**

 **return new DBConnection(name);**

 **}**

 **return null;**

 **}**

 **private static int total = 0;**

 **private DBConnection(String name) {**

 **this.name = name;**

 **}**