

CPSC 101 Winter 2012
Midterm II—09 March 2012

Name (Printed) : _____

Signature : _____

Student Number :

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Question	Score
1	/10
2	/2
3	/4
4	/4
5	/3
6	/3
7	/10
8	/6
9	/2
10	/3
11	/2
12	/2
13	/3
Total	/54

- This is a **50** minute exam. This exam contains **10** pages of questions not including this cover page. Make sure that you have all of them.
- Put your name on the top right hand corner of each page as examination papers sometimes come unstapled.
- *Read each question carefully. Ask yourself what the point of the question is. Check to make sure that you have answered the question asked.*
- Answer all questions on the exam sheet. If you do some of your work on the back of a page, clearly indicate to the marker what work corresponds with which question.
- Partial marks shall be awarded for clearly identified work.
- Non-programmable calculators and simple wrist-watches are allowed. **No cell-phones or other non-medical electronic devices.**
- This exam counts as **15%** of your total grade. There are **54** points total on the exam.

True False

1 each

1. Circle **TRUE** or **FALSE** as appropriate. Questions that don't clearly indicate *one* choice shall be marked wrong. If you feel that the answer depends on how you interpret the question, give a brief reason for the answer you chose.
 - (a) If a class contains an abstract method, the class must be abstract.
TRUE FALSE
 - (b) If a class contains a final method, the class must be final.
TRUE FALSE
 - (c) An overriding method must be at least as public as the method it overrides.
TRUE FALSE
 - (d) A JAVA graphics program doesn't necessarily end when its public static void main(String [] args) method exits.
TRUE FALSE
 - (e) The `java.awt.*` classes are newer than the `javax.swing.*` classes.
TRUE FALSE
 - (f) The JAVA Swing libraries are designed to operate on a single thread.
TRUE FALSE
 - (g) JAVA explicitly supports concurrency.
TRUE FALSE
 - (h) Methods that throw objects from `RuntimeException` (or its subclasses) must declare this with a `throws` declaration.
TRUE FALSE
 - (i) Every exception that can be thrown by an overriding method can also be thrown by the overridden method.
TRUE FALSE
 - (j) The object thrown in a `throw` statement must be an `Exception` (or a subclass of `Exception`).
TRUE FALSE

3. Suppose that `CanadianDollars` is a direct subclass of `Dollars`, which in turn is a sub-class of `Currency`. Suppose further that we are looking at the code:

```
1   Currency debt = new CanadianDollars(3400.15) ;  
2   // ...  
3   System.out.println(debt.value()) ;
```

- (1) (a) In which class must the `.value()` method exist in order for the code to compile?
- (1) (b) Suppose that the `Currency`, `Dollars`, and `CanadianDollars` classes all have `.value()` methods.
Assuming no assignments to `myDebt` between lines 1 and 3, which class's `.value()` method is executed at run-time?
- (2) (c) Now suppose that the `Currency` class and the `Dollars` class have `.value()` methods, but that there is no explicit `.value()` code in the `CanadianDollars` class.
What happens at line 3 at compile- and/or run-time in this circumstance? Justify your answer.
- (4) 4. Write a short piece of code that illustrates the use of the JAVA keyword "`super`". The code doesn't have to be anywhere near complete, but must illustrate where to use the keyword.

Exceptions

- (3) 5. Explain in general terms why error handling is difficult.
- (3) 6. Is it the *dynamic* scope or the *static* scope of `try`-block that is important? Explain. Explain what *static* and *dynamic* scope are about more generally.
7. The following questions are about the technical aspects of exception handling in JAVA.
- (3) (a) What happens when an exception is thrown and there is no `try`-block surrounding the `throw` statement? What happens when an exception is thrown and the nearest surrounding `try`-block has no `catch`-blocks that match the exception thrown?

- (2) (b) What happens when an exception is thrown and the nearest surrounding try-block has multiple catch-blocks that match the exception thrown? What does this say about the order of catch-blocks?
- (2) (c) What is the purpose of a finally-block? That is, when would you use one?
- (3) (d) Draw a sketch of the inheritance hierarchy for Objects that can be thrown and caught in Java.

- (3) 8. (a) The formula to compute the hyperbolic arc cosine, x , of a number u is

$$x = \cosh^{-1} u = \pm \log \left(u + \sqrt{u^2 - 1} \right). \quad (1)$$

For real numbers this formula results in an error if and only if $u < 1$. Write an `arc_cosh` method to compute hyperbolic arc cosines using the positive version of formula (1). Your method should throw an `IllegalArgumentException` when it gets bad input data¹.

- (3) (b) Show how to make `arc_cosh` throw a programmer-defined exception `ImaginaryResultException` that is a direct subclass of `IllegalArgumentException`.

¹`IllegalArgumentException` is in scope without any `import`, and is a subclass of `RuntimeException`. The `log` and \sqrt{x} functions are `Math.log` and `Math.sqrt` respectively.

Graphics and User Interfaces

- (2) 9. Consider the code fragment

```
1   private static void createAndShowGUI() {  
2       JFrame frame = new JFrame("RadioButtonDemo");  
3       frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);  
4       ...
```

Explain what line 3 does and why it is important to put it in simple GUI applications.

- (3) 10. In the code discussed in class the `NameComponent` was written as

```
public class NameComponent extends JComponent  
{  
    public void paintComponent(Graphics g)  
        { /* ... */ }  
}
```

- (a) Why must we use subclassing in order to be able to add `NameComponent` object to a `JFrame` object?

- (b) How does runtime polymorphism help make this code work?

Choose the *best* answer possible, and clearly indicate *one* choice. Supply reasons to the right if you are not sure, or think that the question is open to multiple interpretations.

- (2) 11. The `JFrame` class is
- (a) a framework class for building a GUI.
 - (b) an interface.
 - (c) a top-level window class provided by the `javax.swing` libraries.
 - (d) a top-level window class provided by the `java.awt` libraries.
- (2) 12. The `javax.swing.SwingUtilities.invokeLater` is
- (a) a static method for ensuring that your application quits when its main window does.
 - (b) a non-static method for ensuring that your application quits when its main window does.
 - (c) a static method that invokes its argument on the Swing GUI thread.
 - (d) a non-static method that invokes its argument on the Swing GUI thread.

Longer answer

- (3) 13. Gaddis [*Starting out with Java: From Control Structures through Object* third edition] and Horstmann [*Big Java* third edition] explain exception handling in similar ways. For instance, both introduce exception handling with file i/o.

One of the differences is that Gaddis introduces `try-catch` syntax first before he shows how to throw an exception. Horstmann, on the other hand, first shows how to `throw` an exception.

Comment on which approach you prefer, and which gives the reader a better impression of how to use exception handling. What do you feel is the single most important concept for some learning exception handling to grasp?

```
1 public final class Money
2 {
3     private byte myCents ;
4     private long myDollars ;
5
6     public Money(long dollars, int cents)
7     {
8         myCents = (byte) (cents % 100) ;
9         myDollars = dollars + (cents-myCents)/100 ;
10    }
11    public float asDollars () { return (float)
12                                (myCents/100.0 + myDollars) ; }
13    public long asCents      () { return myCents+ 100*myDollars      ; }
14    // More ...
15 }
```

Figure 1: Code for Question 2 on page 2