UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2013

DEPARTMENT OF COMPUTING

IS52028A Principles and Applications of Programming

Duration: 3 hours

There are five questions in this paper. You should answer THREE out of the five questions. Each question carries 25 marks. The marks for each part of a question are indicated at the end of the part in [.] *brackets.*

There are 75 marks available on this paper.

No calculators should be used.

THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

Question 1

(a) i. Explain the difference between a class variable and an instance variable. [5]

ii. Java method argument passing is pass-by-value. Explain what this means, taking care to distinguish primitive and reference argument types. [5]

(b) Consider the following source code:

```
package exam;

public class Box2 {

    int contents;

    public Box2(int i) {
        contents = i;
        numberOfBoxes++;
    }

    public boolean equals(Box2 b) {
        return b.contents == contents;
    }

    public String toString() {
        return "" + contents;
    }

    public static void decr(int j, Box2 b) {
        j--;
        b.contents--;
    }

    public static void main(String[] args) {
        Box2 a = new Box2(4);
        Box2 b = new Box2(4);
        System.out.println(a == b); // A
        System.out.println(a.equals(b)); // B
        int i = 0;
        decr(i, a);
        System.out.println(i + "\t" + a); // C
    }
}
```

i. What is printed when `main` is executed? [5]

ii. Provide an explanation for your answer. [5]

(c) This line of code, when added to `Box2.main` would cause a compilation error:

```
Box2 d = new Box2()
```

Why is this? How would you fix the error? [5]

Question 2

The class definition of a Book is:

```
package exam;

public class SimpleBook {

    String title;

    public SimpleBook(){
        title = "";
    }

    public SimpleBook(String s) {
        title = s;
    }

    public String toString() {
        return title;
    }
}
```

(a) i. Demonstrate, with example code, how you would construct an object of type `SimpleBook`, and how you would call an instance method of `SimpleBook`. [5]

ii. Write a class method of your choosing for `SimpleBook` and explain where, in the class definition, you would place this method. [5]

(b) i. Why would you want to encapsulate a variable of a class? [5]

ii. Provide code to ensure that the instance variables of `SimpleBook` are encapsulated. [5]

```
public class Book{
    private String title;
    public Strng getTitle(){return title;}
    public void setTitle(String t){title = t;}
   ...
}
```

(c) A more complete representation of a book would include author information. Write a subclass `Book` of `SimpleBook` which adds author data (assume there is only one author). [5]

Question 3

(a) i. Class inheritance is one of the defining properties of the object oriented style of programming. Why is it considered to be a good practice? [5]

ii. Does inheritance have any drawbacks? [5]

(b) i. What is an abstract class? [5]

ii. Write an abstract `Journey` class to represent a journey of any means. (*Hint. A journey has a start and an end.*) [5]

iii. Write a concrete subclass `RailJourney` of `Journey` that represents a journey by train. Provide example code in `RailJourney.main` to illustrate how your classes could be used. (*Hint. A rail journey has a start, an end, and the ticket is either for first or second class travel.*) [5]

Question 4

(a) The JVM organises program memory into stacks and the heap.

i. Explain what the heap is and what it is used for. [5]

ii. Explain how a call stack is used by the JVM. [5]

(b) What is the difference between variable life and variable scope? [5]

(c) When does an object become eligible for garbage collection? Provide code snippets to illustrate your answer. [10]

Question 5

(a) In Android Programming, what is an activity? [4]

(b) Give an examples of two activities that interact with each other [6]

(c) Describe, with an example, how the user interface of an activity is defined and how the interface interacts with program code. [9]

(d) How would you create an activity whose user interface would adapt to different screen sizes. Give an example? [6]