

OLLSCOIL Na hEIREANN
THE NATIONAL UNIVERSITY OF IRELAND

NATIONAL UNIVERSITY OF IRELAND, GALWAY.

SPRING EXAMINATIONS 2000

Third University Examination in Information Technology
Third University Examination in Electronic and Computer Engineering

CT326 Programming III

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Answer any 5 questions
All questions carry equal weight
Time allowed: **three hours**

1. For the Employee Directory Service described in the following narrative:

"The directory service is used to hold details on employees within a company. Employees within a company should be allowed to register themselves with the service - typically they will use the service to register their Name, Department, E-Mail address, Phone Number and any other relevant details. Employees are associated with a particular Department which is managed by a Manager. All users of the service should be able to lookup and display all the entries in the directory. The Manager of a Department should also have the capability to delete or modify any entries for Employees within their own department."

- (a) Derive a top level Class Diagram for this system, showing important attributes, methods and links between classes. **8 MARKS**
- (b) Provide JAVA implementation code for the main classes in the system. Use the `java.util.Vector` class to store the entries. **8 MARKS**
- (c) Discuss briefly how the *Observer* Design Pattern might be used in the design or extension of this system. **4 MARKS**

2.a: Outline briefly some of the potential benefits of using Object Oriented technology. 4 MARKS

b: Describe using suitable code examples the concepts of *polymorphism* and *inheritance*. Are there any potential problems with using inheritance? 8 MARKS

c: Give the full JAVA class definition for an object that represents a typical (text only) E-Mail message. Include methods for the typical operations you would perform on an E-Mail message. Show then how you could reuse this class in the definition of a new (derived) class for messages that can include attachments e.g. an attachment could be a MS Word file or a multimedia clip in a supported MIME format. 8 MARKS

3.a: What is a collections framework ? How is this implemented in the JAVA programming environment ? 4 MARKS

b: Show the output that would result if the following Java program is run with the arguments: "I came I saw and I left again":

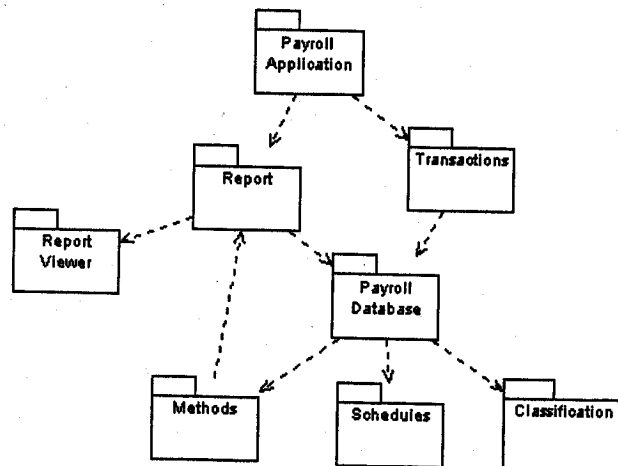
```
import java.util.*;

public class FindDups {
    public static void main(String args[]) {
        Set s = new HashSet();
        for (int i=0; i<args.length; i++)
            if (!s.add(args[i]))
                System.out.println("Duplicate detected: "+args[i]);
        System.out.println(s.size()+" distinct words detected: "+s);
    }
}
```

8 MARKS

c: The JDK contains two general-purpose List implementations i.e. *ArrayList* and *LinkedList*. Why is *ArrayList* generally the best performing implementation ? Describe the circumstances under which *LinkedList* might offer better performance. 8 MARKS

- 4.a: Describe the general structure of the IO Streams classes provided in the Java programming environment.
4 MARKS
- b: What information is normally written out during object serialisation in the Java programming environment ? Describe how you can provide custom serialisation for your own classes.
8 MARKS
- c: Write a simple Java program that creates a *Vector* object and adds a number of *String* objects to the *Vector*. It then serializes the *Vector* object to a file named *theVector*. Finally, it reads in the saved *Vector* object from the file and reconstructs a new *Vector* object from the deserialised data.
8 MARKS
- 5.a: What is meant by the term "*Software Reflection*" and give examples of where it's used.
4 MARKS
- b: Describe the dependency inversion principle. Illustrate using an example (which includes a class diagram). What are the consequences of applying the principle on small systems?
8 MARKS
- c: What problem does the following diagram indicate? How would you solve the problem?



Why would the PayrollDatabase package/component export an abstract (well defined) public interface? What principle does this illustrate?

8 MARKS

6.a: Describe, using a simple example, how parameters in HTML can be passed to and used within Java applets. 4 MARKS

b: Write a Java applet that inputs a telephone number as a string in the form 353-91-524411. The program should use an object of class *StringTokenizer* to extract the country code, area code and number as tokens. The program should then convert these to int values and display them. 8 MARKS

c: What are the advantages of using the JAVA *Vector* class as a container instead of using a conventional array ? Using an example of a simple banking system, show how a *Bank* class might use a *Vector* as a container for a list of *Account* objects. 8 MARKS

7.a: Discuss briefly the differences between a process and a thread. Show how a thread can be created and started using JAVA. 4 MARKS

b: What is meant by the term *deadlock* ? Using the example of the *Dining Philosophers Problem* (covered in class), discuss how deadlock might occur in this case and propose a solution to overcome the problem. 8 MARKS

c: Assume that Producer and Consumer threads share data through a common *IntBuffer* object. This object is used to hold a single integer value which can be consumed exactly once. Describe the design of the *IntBuffer* class, showing in particular how the use of re-entrant monitors can prevent deadlock. Note that neither the Producer nor the Consumer makes any effort whatsoever to ensure that the Consumer is getting each value produced once and only once. 8 MARKS