N10/5/COMSC/SP2/ENG/TZ0/XX

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COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Wednesday 17 November 2010 (morning)

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.

*Answer **all** the questions.*

1. A program has been written to process student data in a school. For each student, the student's name and date of birth are stored. The following class `Student` has been designed to hold these details.

```
class Student
{
  private String name;
  private int yearOfBirth;  // Year in which student was born
  private int monthOfBirth; // 1-12 corresponds to Jan-Dec
  private int dayOfBirth;   // 1-31 day in birth month

  public Student()
  {
    // constructor
  }

  public String getName()
  {
    return name;
  }

  // other methods follow
  // ...
}
```

(a) With reference to the `Student` class, describe the differences between *public* and *private* identifiers. *[4 marks]*

(b) Construct a method `getYearOfBirth()` that returns the year in which a student was born. *[2 marks]*

(This question continues on the following page)

(Question 1 continued)

The `Student` object only stores the date of birth of the student, therefore the age of the student must be calculated based upon the current date.

(c) (i) Assuming that the current date is 17 November 2010, calculate the age, in years, for each of the students in the following table. *[2 marks]*

Student	Year of birth	Month of birth	Day of birth
Student A	2000	08	15
Student B	2000	11	16
Student C	2000	11	18

(ii) Explain how it can be determined if a student's birthday in the current year has passed. *[2 marks]*

(iii) The **`int`** variables `currentYear`, `currentMonth` and `currentDay` hold the current year, month and day, respectively. Using these variables, construct the method `getAge()` that returns the age of a student, in years. *[5 marks]*

(d) The school's student data is contained in a file. The method `getNext()` reads from the file, returning a `Student` object each time it is called. When the end of the file is reached, `getNext()` returns a `Student` object containing the name "`XXX`".

Construct a program fragment that will output a list of the names of all the students whose age is 12. You should use the method `getAge()`. *[5 marks]*

2. A program contains a `String` array of student names and a **`float`** array of student grade averages.

There are **`int`** `numStudents` elements in each array.

For example:

	0	1	2	3	4	...
studentNames	Mary	John	Paul	Luke	Trina	

	0	1	2	3	4	...
gradeAverages	78	62	71	89	52	

The program needs to sort the students into order based on their grade averages.

(a) (i) Outline the advantages of storing the student names and grade averages in arrays. *[2 marks]*

(ii) Construct the method `bestStudent()`, started below, that returns the name of the student with the highest grade average.

```
String bestStudent(String[] names, float[] averages, int numStudents)
{
   // Insert code here
}
```
[4 marks]

(b) (i) Explain why the `gradeAverages` array should not be sorted into descending order without also making changes to the `studentNames` array. *[2 marks]*

(ii) Construct the method `rankStudents()`, started below, that uses a bubble sort to sort the two arrays into descending order based on the grade average.

```
void rankStudents(String[] names, float[] averages, int numStudents)
{
   // Insert code here
}
```
[8 marks]

(c) Explain how the difficulty of keeping the corresponding elements of the two arrays aligned can be avoided by using *objects*. *[4 marks]*

3. *This question requires the use of the case study.*

(a) Terminal 5 has a number of areas that require access to be authorized. The management of the airport is considering introducing different methods of security across the airport.

Smart cards, *magnetic strip cards* and *bar codes* can be used by airport staff as a means of gaining access to any secure area within the airport. The smart cards do not contain biometric information.

(i) Outline why the use of smart cards is an effective security measure. *[2 marks]*

To enhance security the smart cards could be linked to biometric identification systems.

(ii) State **two** types of biometric identification systems. *[2 marks]*

(iii) Describe how biometric identification systems work. *[4 marks]*

(iv) Compare the different levels of security that could be applied to staff and passengers. *[4 marks]*

(b) Operation of each of the airport computer systems is controlled by the **operating system**. Operating systems can be either single or **multi-user** and are capable of allowing **multi-tasking**.

(i) Define the term *operating system*. *[1 mark]*

(ii) Define the term *multi-user*. *[1 mark]*

(iii) Define the term *multi-tasking*. *[1 mark]*

(iv) Identify **three** reasons for multi-tasking in Air Traffic Control. *[3 marks]*

(v) Explain how a multi-user system is used in the check-in system. *[2 marks]*

(c) Outline the principle characteristics of the following modes of operation.

(i) *batch processing* *[2 marks]*

(ii) *real-time processing* *[2 marks]*

(iii) *online processing* *[2 marks]*

(d) Computer systems at the modern airport are linked via a *network*. With reference to the airport systems, outline the meaning of the terms *client* and *server*. *[4 marks]*