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COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Wednesday 15 May 2013 (morning)

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- A clean copy of the ***Computer Science*** *case study* is required for this paper.
- The maximum mark for this examination paper is *[70 marks]*.

*Answer **all** the questions.*

1. Data types and data structures are an important feature of every programming language.

(a) State **two** possible consequences of selecting the wrong data type for the data that you intend to store. *[2 marks]*

(b) Outline a set of data that could be stored in a one-dimensional array of Boolean. *[2 marks]*

(c) Construct the method `howMany()` that will inspect your Boolean array in part (b) and display the number of occurrences of each of the different values stored in it. You can assume that the size of the array is 100, and that your data structure is declared globally. *[5 marks]*

The table below shows the wages paid to five employees for each month of the year (in euros).

	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Adams	2456	2546	2967	3057	2347	2107	2346	3049	3246	3546	5940	3747
Parr	5463	3546	7564	3547	3856	3546	4536	3546	2435	3475	4657	3564
Rooney	4635	4657	4697	4839	4364	3465	5536	3546	2375	3546	3546	2435
Song	6346	7686	4657	9675	3645	6354	9765	2435	3542	6354	3647	3748
Suarez	2533	2536	2175	1869	2398	1384	1346	2813	2738	2738	1296	2375

(d) Describe in full the data structure, `table`, that can be used for storing the **numerical** data shown above. *[2 marks]*

(e) Using your structure in part (d), construct the method `adams()` that would add up the total wages for "Adams" for the year. You can assume that `table` is declared globally. *[5 marks]*

(f) Outline how you could use an additional data structure to link the names of the employees to their wages. *[2 marks]*

(g) Outline how you would modify the method in part (e) so that it could add up the wages of any **named** employee. *[2 marks]*

2. An array of objects is being used to hold the marks for a class of 25 students. Each object is a member of the `Student` class, part of which is outlined below.

```
class Student
{
  double averageMark;
  String surname;
  int studentID;
  int[] marks;

  public double average()
}
```

The values in the `marks` array represent the percentages obtained in 15 tests which are given over the course of the year. They are initially set to –1.

(a) Suggest a reason for initially setting the values to –1. *[2 marks]*

(b) Explain why the `averageMark` variable is of type `double`. *[3 marks]*

The method `average()` in the `Student` class calculates the average mark for a particular student at **any** time during the year.

(c) Construct the method `average()`. *[6 marks]*

The class that processes the `Student` data contains a modified bubble sort method. This method carries out the following steps:

- receives the `Student` array (originally initialized as `Student[] s = Student[25];`)
- calculates the average mark for each student
- sorts the `Student` array by average mark (highest first)
- returns the sorted `Student` array.

(d) Construct this modified bubble sort method. You should make use of any previously defined methods. *[6 marks]*

(e) Explain why it is convenient to store the student data as objects. *[3 marks]*

This question requires the use of the case study.

3. (a) With reference to page 4 of the case study, explain with the use of examples why RAM is also known as *dynamic memory*. *[2 marks]*

(b) Identify the data that would be stored in the *firmware* of a smartphone. *[1 mark]*

(c) Describe **two** ways in which manufacturers have overcome the limited number of options that can be displayed on a touch screen. *[4 marks]*

(d) Explain why the increase in use of 3G/4G phones might be of concern to Internet Service Providers (ISPs). *[3 marks]*

(e) By making use of both positive and negative examples, discuss whether students should be allowed to use smartphones during lessons at school. *[6 marks]*

(f) Outline why one of the chips inside a smartphone will contain an analogue-to-digital converter (ADC). *[2 marks]*

(g) Describe **two** consequences of the low power consumption of *Bluetooth* for smartphone users. *[4 marks]*

Scientists often make use of *sensors* when taking part in field studies.

(h) With reference to a specific example, describe how a smartphone could be used in these studies. *[3 marks]*

(i) Suggest **one** reason for choosing a smartphone that makes use of a "kill" switch. *[2 marks]*

(j) Explain why higher-pixel density leads to sharper images on a screen. *[3 marks]*