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**COMPUTER SCIENCE
STANDARD LEVEL
PAPER 1**

Friday 18 May 2012 (afternoon)

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Section A: answer all the questions.
- Section B: answer all the questions.
- The maximum mark for this examination paper is *[70 marks]*.

SECTION A

Answer **all** the questions.

1. State **two** ways in which a *compiler* will help in the development of a program. [2 marks]
2. Explain why both *validation* and *verification* are important when processing data. [4 marks]
3. State **two** differences between the CPU in a desktop computer and the microprocessor in a washing machine. [2 marks]
4. Outline the *resource monitoring* function of an operating system. [2 marks]
5. In the context of software development, outline the types of data necessary to fully test the system. [3 marks]
6. Outline the function of *formatting* a disk for its first use by an operating system. [2 marks]
7. A picture measures 70 by 100 pixels and is stored as a graphic file. The colour representation uses 5 bits for red, 5 bits for green and 5 bits for blue.
 - (a) Calculate how many different colours can be represented. [1 mark]
 - (b) Each pixel is stored in two bytes. Calculate the size of the graphic file. [1 mark]
 - (c) State **two** ways of storing the file in 12 kB RAM. [2 marks]
8. Consider the following fragment of code.


```
int x = 3;
int[] a = {3, 16, 27, 8, 15, 29, 11, 18};
int y = a[x] % 3;
if (y == 0) output (a[y])
else output (a[y + 1]);
```

State the value that is output. [1 mark]

9. (a) State the content of an 8 bit register which stores the hexadecimal number D4. [2 marks]
- (b) Express the result in part (a) as a decimal number. [1 mark]
10. Outline the role of a *cache* in a microprocessor. [2 marks]
11. Identify **one** advantage of using Magnetic Ink Character Recognition (MICR) instead of Optical Character Recognition (OCR). [1 mark]
12. Explain **two** disadvantages of using *interviews* as a technique for data collection. [4 marks]

SECTION B

Answer **all** the questions.

- 13.** A company has set up a nationwide telephone call centre for enquiries. Depending on the phone number of the caller, a mainframe (central server) redirects incoming calls to one of the four servers, each of them located at a regional centre. The calls will then be directed to the operators in the regional call centre, working with their computers. The network developed is hybrid.
- (a) Construct a labelled diagram showing a suitable hybrid network made up of two basic topologies. *[5 marks]*
- (b) Suggest a physical transmission medium for communication:
- (i) between the mainframe and the four servers at regional centres; *[1 mark]*
- (ii) between the server and the operators' computers. *[1 mark]*
- (c) Explain why switches would be used, rather than hubs, in this hybrid network. *[3 marks]*

14. An array `files` stores the sizes of some files, which we assume to be whole numbers. The order of the elements in `files` respects the chronological order of creation of the files. An application that performs a backup on a USB memory stick uses `files` to preliminarily compare the current capacity of the stick with the sizes required for each file as they appear in the array, before actually starting copying. The application uses the method below. The method is incorrect and we study it for debugging and for improvements.

```
public int[] checkcapacity(int[] files, int capacity)
{
    int s = files.length;
    int[] b = new int[s];
    int i = 0;
    int sum = files[i];
    while (sum <= capacity)
    {
        b[i] = files[i];
        i = i + 1;
        sum = sum + files[i];
    }
    for (int j = i; j < s; j = j + 1)
    {
        b[j] = 0;
        return b;
    }
}
```

- (a) State the terminating condition for the **while** loop. [1 mark]
- (b) By copying and completing the table started below, trace the method when `files` is the array {3, 7, 1, 2, 9, 8} and `capacity` is 15. [3 marks]

b	i	sum	j
{0, 0, 0, 0, 0, 0}	0	3	

- (c) Suggest why the **for** loop is superfluous and hence can be safely removed. [1 mark]
- (d) Identify which values for the parameters will cause the **while** loop to never execute. [1 mark]
- (e) (i) Suggest which values for the parameters would cause the program to produce a run-time error. [2 marks]
- (ii) Suggest how this situation could be avoided by modifying the program. [2 marks]

- 15.** In a self-service fuel station, each pump has a touchscreen display equipped with a credit card reader and a printer for receipts. All these peripherals are connected to a common computer that can communicate with the various credit card companies. The pumps are set to deliver up to a maximum of 70 EUR of fuel.

The customer inserts the payment card, enters the PIN and chooses the type of fuel. The card is returned after validation and authorization from the credit card company, and only if these operations were successful can the fuel be dispensed. Finally, the customer can choose to have a printed receipt with the actual expenditure.

- (a) Describe the process that takes place at the station's computer after the card's PIN is entered through the touchscreen. *[2 marks]*
- (b) Identify **one** piece of information that the computer at the fuel station needs to communicate to the credit card company if the authorization was successful. *[1 mark]*
- (c) Construct the system flowchart for the scenario described above. *[4 marks]*

At night, the self-service fuel station may not be a particularly safe place.

- (d) Explain why the owner of the fuel station has decided to set a limit of 70 EUR. *[3 marks]*

16. A sequential file on a disk of a central computer stores records on some products, including the following information:

- a unique alphanumeric product code
- product name
- minimum price
- maximum price.

The two price fields determine the price range in which the product can be sold. They are updated once a week.

The file is mostly used for reference. The records are ordered on the alphanumeric product code.

(a) Outline why sequential access is suitable for the update. *[2 marks]*

(b) Suggest with reasons an efficient procedure for a retailer to store records of fixed-length on some products. *[2 marks]*

An application needs to access the file for consultation, to verify that the price of a certain product currently on the shelf falls within the established boundaries.

(c) Outline the steps required in this process. *[2 marks]*

During the next file update, a record for a new product needs to be added.

(d) Evaluate the effects of this operation on the file, in the given scenario. *[2 marks]*

The retailer now wants to access the file remotely, to perform an interactive processing, and discovers that access times to the file are too slow.

(e) Explain why a direct access file would be an appropriate file organization in this novel scenario. *[2 marks]*