Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Standard level
Paper 1

Friday 29 October 2021 (afternoon)

1 hour 30 minutes

Instructions to candidates

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

8821 – 7014

5 pages

Section A

Answer **all** questions.

1. Outline **one** usability issue of a cell phone (mobile phone). [2]

2. State **two** differences between primary storage and secondary storage. [2]

3. Outline why computers use the binary number system. [2]

4. Explain why compression of data is beneficial when transmitting data files across a network. [3]

5. A group of programmers are involved in creating a new software product. They create many new sub-programs but also use existing sub-programs within the product.

(a) Outline why a sub-program is considered an example of abstraction. [2]

(b) Evaluate the use of designing and developing different parts of software products concurrently. [3]

(c) Outline **one** way in which users can be informed of software updates. [2]

6. (a) Explain how data is sorted by the selection sort. [3]

(b) Outline **one** difference between a bubble sort algorithm and a selection sort algorithm. [2]

7. Assume X = 5 and Y = 3.

Determine the value of the following expression: [1]

$$(X <= 5) \text{ XOR } (Y > X)$$

8. Construct a trace table for the following algorithm:

```
K = 0
I = 0
loop while 6 > I
    K = K + I
    I = I + 2
end loop
output(K)
```
[3]

Section B

Answer **all** questions.

9. A new computer system is being developed using prototypes.

(a) (i) Outline **one** advantage of using surveys as a method of obtaining requirements from stakeholders. [2]

(ii) Outline **one** disadvantage of using surveys as a method of obtaining requirements from stakeholders. [2]

(b) Identify **one other** method of obtaining requirements from stakeholders. [1]

(c) Outline **two** advantages of using prototypes. [4]

(d) Explain why more than one cycle of analysis and design might be needed. [3]

(e) Explain why this computer system should be tested thoroughly before being put into operation. [3]

10. A company has a large networked computer system.

Some of its data is non-sensitive data that would cause no risk to the company if accessed. Some data, however, is sensitive, such as the company's financial records and documents that contain trade secrets and personal information about employees or clients.

(a) Outline **two** ways in which access to sensitive data can be managed. [4]

(b) Outline **two** ways to improve the security of the company's network. [4]

Data corruption can result in data loss.

(c) Explain how corrupted data files can be recovered. [4]

The company is considering implementing a virtual private network (VPN).

(d) Explain **one** benefit to the company of using a VPN. [3]

11. A bus company provides services within a city. The basic fare depends on the travel distance between the departure station and the destination station.

The cost per kilometre is €0.20.

Children under the age of 5 can travel for free.

Children between the ages of 5 and 15 **inclusive** can travel with a child age ticket, which gives a 50 % discount off the kilometre fare.

The senior discount (age 65+) offers 30 % off the kilometre fare.

The sub-program `costperkm(AGE)` accepts an integer `AGE` (the age of a passenger), then calculates and returns the cost per kilometre.

For example,
`costperkm(10)` returns 0.1,
`costperkm(20)` returns 0.2,
`costperkm(80)` returns 0.14

(a) Construct an algorithm in pseudocode for the sub-program `costperkm(AGE)`. [4]

Passengers can find the distance between any two bus stations.

Figure 1 shows the one-dimensional array `NAMES`. It is used to store the names of all bus stations on the route from Oppox to Dovely.

Figure 2 shows the one-dimensional array `DISTANCES`. It is used to store the distances (in kilometres) on the route from Oppox to Dovely.

Figure 1: `NAMES`

[0]	Oppox
[1]	Thamesley
[2]	Brinkley
[3]	Kiko
[4]	Endsley
[5]	Kingsley
[6]	Allapay
[7]	Kronos
[8]	Longlines
[9]	Dovely

Figure 2: `DISTANCES`

[0]	0
[1]	**1.2**
[2]	**1.0**
[3]	**2.2**
[4]	**1.3**
[5]	**1.4**
[6]	**0.9**
[7]	**1.1**
[8]	**1.2**
[9]	**0.9**

(This question continues on the following page)

(Question 11 continued)

`DISTANCES[K]` holds the distance between the bus stations `NAMES[K-1]` and `NAMES[K]`.

For example, the distance between Kronos (`NAMES[7]`) and Longlines (`NAMES[8]`) is 1.2 km and can be found in `DISTANCES[8]`.

(b) State the distance between Kiko and Endsley. [1]

(c) State the distance between Oppox and Brinkley. [1]

The sub-program `calcdistance(P1,P2)` accepts the indexes of the names of two bus stations in the array `NAMES`, where index `P1` is always less than index `P2`, and returns the distance between them.

(d) Describe how the distance between the two bus stations can be calculated in this sub-program. [3]

An algorithm is needed that inputs the names of the two bus stations and the age of the passenger. It then calculates and outputs the price of a ticket.

If any of the inputted names are not found, the algorithm outputs an appropriate message. **Figure 3** shows three examples of inputs and outputs.

Figure 3: Three examples of inputs and outputs from the algorithm

Input 1	**Input 2**	**Input 3**
Allapay	Thamesley	Paddington
Kiko	Brinkley	Oppox
50	76	16
Output 1	**Output 2**	**Output 3**
€0.72	€0.14	One or more stations not found.

(e) Construct an algorithm as described. You should call sub-programs `costperkm()` and `calcdistance()` in your algorithm. [6]

References: