

**BCS THE CHARTERED INSTITUTE FOR IT**  
**BCS HIGHER EDUCATION QUALIFICATIONS**  
**BCS Level 4 Certificate in IT**

**SOFTWARE DEVELOPMENT**

Monday 25<sup>th</sup> March 2019 - Afternoon

Time: TWO hours

**Section A** Answer 2 questions (out of 4). Each question carries 30 marks.

**Section B** Answer 5 questions (out of 8). Each question carries 12 marks.

Section A and Section B each carry 50% of the marks. You are advised to spend about 1 hour on Section A (30 minutes per question) and 1 hour on Section B (12 minutes per question).

**Answer the Section A questions you attempt in Answer Book A**

**Answer the Section B questions you attempt in Answer Book B**

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are <b>NOT</b> allowed in this examination.
---

**The BCS Professional Examination Certificate**

**Software Development**

**Section A**

**Answer 2 questions (out of 4). Each question carries 30 marks.**

**Section B**

**Answer 5 questions (out of 8). Each question carries 12 marks.**

## SECTION A

Answer 2 questions (out of 4). Each question carries 30 marks.

- A1** An array called *correct* contains the correct values for eight measurements. The array *experiment* contains the values obtained by students for the same measurements. The array *score* contains the marks awarded for their attempts. If an experimental result is within 1% of the correct value, the score is 8; if the result is within 10%, then it scores 4, otherwise 0.

	0	1	2	3	4	5	6	7
correct	100.0	200.0	50.0					

	0	1	2	3	4	5	6	7
experiment	100.5	215.0	80.0					

	0	1	2	3	4	5	6	7
score	8	4	0					

- a) Write code to calculate the values in array *score* assuming the arrays *correct* and *experiment* exist and contain values. **(8 marks)**
- b) Convert the code you have written for part (a) into a function (or procedure) called *marking* which has 4 parameters *high*, *tight*, *low*, *loose*. *High* and *low* are the scores awarded (c.f. 8, 4) and *tight* and *loose* are the percentage differences allowed (c.f. 1, 10). **(8 marks)**
- c) Write a function to find the sum of the values in the *score* array, expressing it as a percentage of the maximum score possible. **(6 marks)**
- d) Write a complete program using your answers to (b) and (c) which reads 8 values into the array *correct* from one file, 8 values into the array *experiment* from another file, and computes the percentage score. **(8 marks)**

- A2** A class of 100 students were asked in a survey to name their favourite fruit and their answers are available in an array called *Fruit* as shown below:

	0	1	2	3	4	...	98	99
<i>Fruit</i>	"apple"	"pear"	"banana"	"pear"	"grape"	...	"apple"	"cherry"

Write a program to

- a) list all the different fruit mentioned in the students' answers; **(15 marks)**
- b) find the most popular fruit in the class. **(15 marks)**

(In the event that two or more fruits share the top place in the survey with the same number of votes, the program should report just one of the top answers together with a message saying that there was a 'tie' for first place.)

**A3** Consider the following function that has been created as part of a sorting program:

```
void bubble(int n) {
    int i;
    for (i=1; i<n; i++) {
        if (v[i-1]>v[i]) {
            v[i-1]=v[i];
            v[i]=v[i-1];
        }
    }
}
```

a) If the array *v* has been initialised as follows trace the function call bubble(8)

	0	1	2	3	4	5	6	7
v	9	7	5	3	2	4	6	8

**(16 marks)**

b) The student who wrote this function was trying to create a component of a sorting program. What has gone wrong? Correct the mistake that you have pointed out.

**(6 marks)**

c) Using your corrected version of bubble, go on to create a function sort that can fully sort the array *v* into ascending order.

**(8 marks)**

**A4** a) Consider the code below and format it in a more familiar human-readable form.

```
int fF(int k0){int
i;if(k0>0)for(i=2;i<k0;i++)k0=k0*i;return(k0);}
```

**(6 marks)**

b) Explain what is wrong with each of the following definitions and give a correct definition.

- i) Identifiers are made up of any mixture of lowercase letters and digits;
- ii) Identifiers are made up of any mixture of letters optionally followed by a digit.

**(6 marks)**

c) Referring to the code in part (a), find and write out the following:

- i) all the different identifiers;
- ii) all the different constants;
- iii) a conditional (logical, boolean) expression;
- iv) a conditional statement;
- v) the statement that is repeated by the loop.

*[Note that you should copy out exactly what is requested and no more]*

**(10 marks)**

d) Write out the code from (a) again, this time replacing the for-loop with a while-loop.

**(8 marks)**

## SECTION B

Answer 5 questions (out of 8). Each question carries 12 marks.

- B5** A business intends to make a long-term investment that will give them compound interest. The formula to calculate annual compound interest is:

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

Where:

A = Final Amount

P = Principal Amount or Initial Investment

r = annual interest rate as a decimal

n = number of times interest compounded each year

t = number of years

- (a) Write an expression in pseudocode to calculate the Final Amount using the formula above. **(4 marks)**
- (b) Incorporate your expression into pseudocode or a program in a language of your choice in which variables P, r, n and t are input and the Final Amount is printed for each year. **(8 marks)**

- B6** It is often necessary for programmers to search through an array of data to find a particular element.

- a) Use a linear search method to find an item of data from the unsorted 15 element integer array shown below:

**Data {1, 54, 4, 76, 32, 12, 14, 3, 31, 52, 65, 45, 13, 89, 17}**

The output must indicate the array location of the data item and the solution can be written in either pseudocode or a programming language of your choice. **(8 marks)**

- b) Briefly describe how a binary search operates and state why it would NOT be a suitable method to use for this particular data. **(4 marks)**

- B7** Web based interactive forms contain a range of interface elements that are suitable for the user to enter data. Identify FOUR elements on a typical website interactive form and in each case, draw the element and describe the type data entry for which it is most suitable.

*[Note that it is not necessary to draw the complete web page.]*

**(12 marks)**

- B8** Testing strategies are an important part of software development.

- a) Describe the term *dry run testing*.

**(2 marks)**

- b) Describe the concept *white box testing* and discuss the limitations of using this technique.

**(6 marks)**

- c) Discuss the skills that will be needed to implement white box testing successfully.

**(4 marks)**

- B9**
- a) What do you understand by the term *debugging*? **(4 marks)**
  
  - b) In a simple programming environment where the programmer has only the standard output facilities of the programming language to use, how is debugging approached? **(4 marks)**
  
  - c) What extra facilities might be provided to assist in debugging in a more extensive development environment? **(4 marks)**

**B10**

Write brief notes to distinguish between the following related terms:

- a) Lexical analyser / Parser; **(4 marks)**
  
- b) Compiler / Interpreter; **(4 marks)**
  
- c) High level language / Machine Code. **(4 marks)**

**B11**

Prototyping is a widely-used software development method when the system requirements are unclear.

- a) Draw and label a diagram of the Prototyping technique. **(6 marks)**
  
- b) Briefly explain how Prototyping operates. **(2 marks)**
  
- c) Describe **TWO** advantages of using Prototyping for developing software. **(4 marks)**

**B12**

Answer the questions by referring to the version of the code in C shown below:

Code in C
<pre>int f(int j,int k){int i,m;m=0;for(i=0;i&lt;= 7;i++)if(j&lt;=v[i]&amp;&amp;v[i ]&lt;=k)m++;return m;}</pre>

- a) Comment on the presentation / layout of this code. **(2 marks)**

- b) Rewrite the code to make it look more conventional. **(4 marks)**
- c) Could the original code run successfully without the changes made in part b)?  
Give reasons for your answer. **(2 marks)**
- d) Explain in your own words what the code is trying to achieve. **(2 marks)**
- e) Apart from the changes made in part b), suggest one further improvement  
that could be made to the code. **(2 marks)**

**END OF EXAMINATION PAPER**