

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

Software Development

Wednesday 30th September 2015 - Morning

Time: TWO hours

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 NOT allowed in this examination.

SECTION A

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

A1

- a) Write a program to find the maximum number in an array A. **(8 marks)**
- b) Write two separate functions MAX() and MIN() to return the maximum and minimum values in the array. **(8 marks)**
- c) In an experiment the temperature of a certain component has been recorded every minute for an hour. It is now required to analyse the results.

The *first output required* is the average temperature.

The *second output required* calculates an average temperature but excludes in the average calculation any value that matches the maximum or minimum value recorded.

Write a program to produce these two averages. **(14 marks)**

[Note: in part c) answers which make good use of functions will obtain the most marks]

A2

In a word-based guessing game, Player 1 starts by choosing a secret 6 letter word, for example.

	0	1	2	3	4	5
SECRET	'A'	'N'	'I'	'M'	'A'	'L'

Player 2 then guesses a letter one at a time. For each attempt, if the guessed letter is in the secret word it is revealed. So after two correct guesses ('L' and 'I', say) the situation could be

	0	1	2	3	4	5
REVEALED	'@'	'@'	'I'	'@'	'@'	'L'

[The position of not-yet-guessed letters is marked by the "@" symbol (@).]

If Player 2 guesses 'A' next then both 'A's in the secret word should be revealed

	0	1	2	3	4	5
REVEALED	'A'	'@'	'I'	'@'	'A'	'L'

Player 2 wins if the whole word is revealed in 12 guesses or less, otherwise Player 1 wins.

Write a program where Player 1 can type in their secret word and then hand over to Player 2 to type in individual letter guesses. The program must show the REVEALED letters after each guess and announce the winner.

(30 marks)

A3

Consider the following program

```
void W(int X,int Y){
    int Z;
    for(Z=0;Z<5;Z++){
        if(V[Z]==X || V[Z+1]==Y) V[Z]='y'; else V[Z]='n';
    }
}
```

	0	1	2	3	4	5
V(initial)	4	4	5	5	6	6
V(final)						

a) With the array V having values as shown in the diagram, trace the call of W(5,6)

(12 marks)

b) If the intention had been to turn an element into 'y' if that element matched X and the adjacent element on the right matched Y (and into 'n' if the test failed), how would you change the code?

In this case the result of tracing the call of W(5,6) would be

	0	1	2	3	4	5
V(initial)	4	4	5	5	6	6
V(final)	n	n	n	y	n	6

(4 marks)

- c) The intention to work with an element and the adjacent element on the right and to change the element to 'y' or 'n' remains. But this time the test is whether both elements lie between X and Y. How would you change the code for this case? In this case the result of tracing the call of W(5,6) would be

	0	1	2	3	4	5
V(initial)	4	4	5	5	6	6
V(final)	n	n	y	y	y	6

(6 marks)

- d) Rewrite the code of part c), choosing better names to replace W, X, Y, Z.

(8 marks)

A4

- a) Consider the code below and write it out in a more familiar human readable form.

```
char* x(char y){char* z;if('0'<=y&& y<'8')z="octal";else
z="error";return(z)}
```

(6 marks)

- b)

- Explain the difference in a program between writing 10 and "10"
- Explain the difference in a program between writing 10 and 10.0

(2 x 4 marks)

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

- all the different identifiers
- all the different constants
- the type of the function parameter
- the type of the function result
- a conditional (logical, boolean) expression
- an assignment statement

(6 x 2 marks)

- d) By using an opposite test, an if statement can be "turned round" from *if(test)A else B* to *if(opposite)B else A*. Turn round the if-statement from the program in a):

- first using the not (!) operator
- secondly without using the not (!) operator.

(2 x 2 marks)

SECTION B

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

B5

Black box testing is a method commonly used to test software.

- a) Briefly outline the term *black box* testing. (2 marks)

- b) Describe **one** advantage and **one** disadvantage of using *black box* testing. (2 x 2 marks)

- c) Explain the term *Boundary Value Analysis* in the context of *black box* testing. (4 marks)

- d) A system being tested expects a number to be input between 50 and 120 inclusive. List the values that would be used for testing these boundaries. (2 marks)

B6

An exact conversion of a temperature in degrees Celsius (C) to degrees Fahrenheit (F) is achieved by the equation:

$$\frac{F - 32}{C} = \frac{9}{5}$$

However an approximation to the Fahrenheit scale, is to “*double the Celsius temperature and add 30*”.

a) Express this approximation algebraically. **(2 marks)**

b) Write pseudocode, or a program in a language of your choice, which prints a table of temperature values where each row consists of a temperature in Celsius, two temperatures in Fahrenheit and the difference between the two temperatures in Fahrenheit.

An initial and final Celsius temperatures and the interval to be used between these values is input interactively by the user. The Fahrenheit temperatures are calculated using both formulae (exact and approximation) and the difference between the two Fahrenheit values is shown in the last column.

(10 marks)

B7

a) What does the term *sequential access* mean? **(4 marks)**

b) Briefly describe a part of a computer system which can be used as a sequential access device. **(4 marks)**

c) Give brief details of a situation in which a sequential file would ideally be used. **(4 marks)**

B8

a) Name two algorithms that can be used for searching for data in an array. **(2 marks)**

b) For BOTH algorithms that you named in a), briefly describe how the algorithm works. **(2 x 5 marks)**

(Note: no code is required)

B9

Supply the words to complete the following sentences:

- a) The two phases of the software development life cycle that follow analysis are _____ and _____.
- b) Two popular methods of sorting are _____ and _____.
- c) Linux OS is an example of _____ software and Microsoft Word is an example of _____ software.
- d) The hexadecimal system operates in _____ and uses digits (0 to 9) and the letters (A to F), whereas the octal system operates in base 8 and uses the digits _____.
- e) The acronym OOP stands for _____.
- f) The basic (or primitive) data type Boolean can have values of _____ and _____.
- g) White space is any program text that is made up of _____, _____ and _____.
- h) _____ errors are detected at compile time, the compilation cannot be completed until these errors are _____.
- i) An algorithm is a set of _____ to solve a problem; it can be in the form of a flowchart or _____.
- j) Two ways to obtain a one-from-many selection from a user on a web-based form are _____ and a _____.
- k) The alternative names for the data structures called LIFO and FIFO are _____ and _____.
- l) Random Access means reading from or writing to a memory location _____, rather than being accessed in a _____.

(12 x 1 mark)

B10

Compare the following pairs of terms.

- | | |
|----------------------------------|-----------|
| a) A compiler and an interpreter | (4 marks) |
| b) Internal and external memory | (4 marks) |
| c) Design and implementation | (4 marks) |

Note: You are advised that three well-chosen sentences per pair will be sufficient – one sentence describing the first term, one sentence describing the second term and one sentence highlighting the difference between the terms.

B11

- a) There are many kinds of errors that can occur in a program. Describe the following kinds of errors:

- i) Syntax error
- ii) Type error (type check error)
- iii) Overflow error

(3 x 2 marks)

- b) For each of the types of errors mentioned in part a), give a simple program extract in a language of your choice to demonstrate each error.

(6 marks)

B12

A graphic user-interface (GUI) is designed to meet the needs of the individual that is using it. Describe **THREE** features that you would include in the GUI of an interactive website for a travel agency where you could book a holiday, flight, hotel, etc. In each case explain the functionality of the feature you have chosen.

(12 marks)

