BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 27th September 2017 – 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 any Section A questions you attempt in Answer Book A
Answer any 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

Two measuring devices, at opposite ends of a room, are measuring the room temperature and readings are taken every hour.

a) Write a function (called highDevice) to create a new array (called HIGH) which has an entry 1 if DEVICE1 is reading higher than DEVICE2, 0 if they are the same and 2 if DEVICE2 is reading higher than DEVICE1.

(8 marks)

```
DEVICE1 18 19 20 21 22 21 20 19 18 17 16 18
DEVICE2 18 19 21 21 20 19 20 19 19 16 17 18

HIGH     0  0  2  0  1  1  0  0  2  1  2  0
```

b) Write a function (called doCount) to find out how many times a particular number (supplied as a parameter) appears in an array (in the example above the number 2 appears 3 times in the array HIGH).

(8 marks)

c) Write a function (called doRMS) to find the root-mean-square difference between the readings of DEVICE1 and DEVICE2 (that means: find all the differences in the readings, square them, find the average and then take the square root of the average).

(8 marks)

d) Write a program, using the functions in parts a), b) & c) to report the RMS difference and to report which of the two devices reads high most often (or whether it is a tie).

(6 marks)

A2

All the students taking a module have filled in a questionnaire which contained 10 questions. Each question was answered with the same scale:

Strongly Disagree [ ] Disagree [ ] Neutral [ ] Agree [ ] Strongly Agree [ ]

The students answers have been coded from 1 (Strongly Disagree) to 5 (Strongly Agree) so that the 10 answers from each student are coded as 10 numbers from 1 to 5. This data is now ready to be analysed.

You are to write a program to read and analyse the data from 50 students. The students' answers are to be given scores [-5, -2, 0, 2, 5] so that "Strongly Disagree" is scored -5 and "Strongly Agree" is scored 5.

The average score for each question should be calculated and reported. Finally the question with the lowest total score should be reported.

(30 marks)

[Note: For maximum marks your program should make use of functions and it should be possible to change the scoring system easily (e.g. from [-5, -2, 0, 2, 5] to [-2, -1, 0, 1, 2]).]

A3

a) Give the final values of the variables a, b, c, d after the following code has executed:

(4 marks)

```
i=2; a=--i; b=i;
i=4; c=i--; d=i;
```

b) Based on your answer to part a), or otherwise, state the key difference between --i and i--.

(4 marks)

c) Given the initial values in the array V as follows:

```
index 0   1   2   3   4   5
V     17  15  13  12  14  16
```

trace the execution of the function call ***f***(5), where the function ***f*** is defined as follows:

(18 marks)

```
int f(int g){
      int h=V[g];
      int i=g;
      while(i>0){
            int j=V[--i];
            if(j<h)h=j;
      }
      return h;
}
```

d) Describe in your own words the result that function ***f*** produces and thus give it a more meaningful name.

(4 marks)

A4

Based on the following program extract, answer the questions below:

```
#include <stdio.h>
float g(int x, int y, char a){
      float r;
      if(x<0||y<0)return -1;
      if(a=='*'){r=x*y; return r;}
      if(a!='/')printf("unexpected:%c",a);
      return(x/y);
}
```

a) List all the identifiers in the extract.

(5 marks)

b) List all the operators.

(5 marks)

c) List all the constants.

(5 marks)

d) List the types of each of the constants in c).

(5 marks)

e) From the program extract, copy out an example of each of the following:

a declaration,
a boolean expression,
an assignment statement,
a conditional statement.

(10 marks)

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

B5

Values for the hyperbolic cosine function are obtained from the power series

Cosh(x) = 1 + x^2 / *fac*(2) + x^4 / *fac*(4) + x^6 / *fac*(6) + …

where: ***fac***(n) = factorial n = 1*2*3*4*…*n

Note: - Use pseudocode or actual program code of your choice to answer this question.

a) Write code for ***fac***(n); any method may be used. **(4 marks)**

b) Incorporate your function into another function HCos(x) which calculates Cosh(x) using the power series given above. Show how to terminate the calculation when the difference between successive terms is less than 0.00005.

(8 marks)

B6

Iteration is commonly used in computer programming. Describe, with examples, **THREE** different forms of iteration found in programming languages such as C.

(3 x 4 marks)

B7

a) Explain the difference between internal and external sorting.

(4 marks)

b) Describe the stages that take place when performing a merge sort.

(6 marks)

c) State one advantage and one disadvantage of using the merge sort procedure.

(2 marks)

B8

a) What is normally meant by the term 'debugging'?

(4 marks)

b) How is debugging approached in a simple programming environment where the programmer has only the standard output facilities of the programming language to use for this purpose?

(4 marks)

c) What extra facilities to assist in debugging might be provided in a more extensive development environment?

(4 marks)

B9

Briefly describe the type of testing you would use for:

a) Unit tests **(6 marks)**
b) Integration testing **(6 marks)**

Give reasons for your answers.

B10

Write brief notes to compare and contrast the following pairs of terms

a) source code and object code **(4 marks)**
b) linkers and loaders **(4 marks)**
c) multi-user and multi-tasking **(4 marks)**

B11

Explain the difference between open source and closed source software. Compare and contrast these two approaches to software provision.

(12 marks)

B12

Documentation is an important aspect of software development. Write brief notes on the following:

a) The purpose, the content and the methods for delivering end-user documentation.

(6 marks)

b) The content and purpose of the requirements documentation. **(6 marks)**