BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 25th September 2013 -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 100 students have attended 12 courses and in a survey have ranked each course between 1 (bad) and 5 (excellent) and their responses are available in a data file. The file contains 1200 numbers with the first 100 values being the students' rankings for course 1, the next 100 for course 2, and so on, finishing with course 12.

Write a program to find

a) the average ranking for each course **(10 marks)**
b) the number of the course which has the lowest average ranking, and **(10 marks)**
c) the number of the course where there is most agreement **(10 marks)**

[*Hints: The course with the most agreement is one with the smallest value obtained after adding up the squares of the differences between a student's ranking and the average ranking for a course (this is also called the mean square difference).*

Higher marks will be obtained for a program which uses functions and in which the numbers of students and courses can be changed easily.]

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
Fruit	"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]

Turn over]

A3 Consider the code below and the data given for array *A* and then answer the questions below.

```
int A[10];
int f(int v1,int v2,int v3){
     int i;
     for(i=0;i<10;i++){
          if(v1==A[i] && v2==A[i+1] && v3==A[i+2])
               return i;
     }
     return -1;
}
```

	0	1	2	3	4	5	6	7	8	9
A	'Q'	'W'	'E'	'R'	'T'	'Y'	'U'	'I'	'O'	'P'

a) Trace the call of f('R','T','Y'). **(6 marks)**

b) Describe what you see to be the purpose of this function. **(6 marks)**

c) What error is there in the function which was not shown up in the trace? **(6 marks)**

d) Rewrite the function to correct the error. **(6 marks)**

e) An advanced version of the function is to be written where the three parameters *v1*, *v2* and *v3* are to be replaced by two parameters *V* and *N*. In this version *V* is an array and the first *N* values of *V* are to be used in a similar manner to *v1*, *v2* & *v3*. Assume the value of *N* will be 0<*N*<11. Write the code for this new version **(6 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.

Defn i) Identifiers are made up of any mixture of lowercase letters and digits
Defn 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 only 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*]

(5 x 2 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 computer supplier offers online customers a discount based on the size of their orders, the details are given in the table below:

Customer Order (£)	Order integer (divided by 1000)	Discount (percentage)
Less than 999	0	0
1,000 to 2,999	1, 2	0.05
3,000 to 4,999	3, 4	0.10
5,000 to 9,999	5, 6, 7, 8, 9	0.20
Greater than or equal to 10,000	10	0.25

a) Use pseudocode or actual program code of your choice to develop a solution to calculate the discount making use of a CASE (or SWITCH) statement; where the initial value of an order is input (for example £2,500) and the discount and the final cost of the order is outputted.

(5 marks)

b) Develop an alternative solution to a) using IF-THEN-ELSE statements using pseudocode or actual program code of your choice.

(5 marks)

c) Describe an advantage of using the CASE (or SWITCH) statement rather than IF-THEN-ELSE statements to solve this problem.

(2 marks)

B6 One of the common operations required of a computer program is to sort items into ascending (or descending) order.

a) Briefly describe in words the bubble sort process. **(2 marks)**
b) Explain a disadvantage of using the bubble sort approach. **(2 marks)**
c) Use pseudocode or actual program code of your choice to describe the bubble sort algorithm. **(8 marks)**

B7 a) i) Show diagrammatically a linked list of 4 nodes, where each node consists of one pointer and one integer data item.
There is no need to include any values in your diagram.

(2 marks)

ii) Give a declaration of this data structure in a language of your choice.
State what language you are using.

(2 marks)

iii) State an application for which this particular data structure is useful and why. **(2 marks)**

b) i) Show diagrammatically a one-dimensional array with one subscript.

(2 marks)

ii) Give a declaration of this data structure using the same language as in part a).

(2 marks)

iii) State an application for which this data structure is suitable, giving reasons for your answer.

(2 marks)

Turn Over]

B8 Give a BRIEF definition of the following terms:

a) Prototype

b) 4GL

c) Parallel processing

d) Data type

(3 x 4 marks)

B9 Design the GUI for a web system to be used as an e-commerce operation for an online book seller. The design should consist of no more than TWO screens and must include a window layout that contains THREE different types of interface element, which are suitable for using in the e-commerce process. Explain your design fully, using diagrams to illustrate your layout.

(12 marks)

B10 Write BRIEF notes to compare and contrast the following pairs of terms:

a) compile time / run time

b) systems software / application software

c) specification / design

d) queue / stack

(3 x 4 marks)

B11 a) What is the difference between a syntax error and a run-time error?

(3 marks)

b) For each of the three types of errors below, provide an example of the error by giving a one line extract from a program. Give a precise description of the error in each case.

i) A syntax error in an expression

(3 marks)

ii) A syntax error in a statement

(3 marks)

iii) A run-time error in an expression

(3 marks)

B12 It is common to take an iterative and incremental approach to software development; sometimes this is called a cyclical approach.

a) Draw and label a diagram showing an iterative and incremental approach to software development.

(6 marks)

b) Briefly explain how an iterative and incremental approach operates

(2 marks)

c) Describe **ONE** advantage and **ONE** disadvantage of using these techniques for developing software

(4 marks)