BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 21st March 2018 – Afternoon
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 <u>Section A</u> questions you attempt in <u>Answer Book A</u>
Answer any <u>Section B</u> questions you attempt in <u>Answer Book B</u>

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

Calculators are **NOT** allowed in this examination.

A1

A sorting method called "insertion sort" receives numbers for sorting and places them in an array **S** in sorted order by finding the proper place for a new number. If the new number is larger than any in the list it is added at the end otherwise space is made for it by moving larger numbers along one space. In the diagram below the number 33 has been included in its correct position by moving all the larger numbers (44, 55) along one place and inserting 33 in the gap created.

	0	1	2	3	4	5	6	7
S (before 33)	22	44	55					

	0	1	2	3	4	5	6	7
S (after 33)	22	33	44	55				

a)   Write a function called insert_new (**N,S,C**) which inserts the new number **N** into the sorted array **S** and where **C** is the count of the numbers currently in **S**.   **(10 marks)**

b)   Make a new version of insert_new called insert_new_id (**N,I,S,SI,C**) where **N**, **S** and **C** are as before but where **SI** is a separate array and when **N** is placed into a certain position in **S** then **I** is placed in the corresponding position in **SI**.   **(10 marks)**

c)   Now suppose that the sales of 100 books are available in a file. The file consists of pairs of numbers and in each pair the first number is the ISBN of the book (that is, the book's unique number) and the second number is the number of copies sold. Use the function that you created in b) to sort this data and then add a reporting function to list the ISBN and sales of each book in order of sales, with the biggest seller first.   **(10 marks)**

A2

A personal finance package is to collect items of expenditure recorded by month (1-12), amount (£ GBP), and category (1=food, 2=clothing, 3=transport, 4=entertainment, 5=savings). The information is stored in three arrays as follows: [If it helps, the size of the arrays can be assumed to be 100.]

	0	1	2	3	4	...	98	99
Month	1	1	1	1	2	...	12	12
Amount (£)	10.01	5.56	4.00	33.99	6.76		7.68	0.99
Category	1	2	1	3	5		4	2

Write a program to:
a)   find and report the year total (£) for each category.   **(10 marks)**
b)   find and report the most expensive month (the month with the most money spent during the year).   **(10 marks)**
c)   find the most expensive category (the category with the most money spent in the year).   **(10 marks)**

A3

The array **x** has been initialised as follows

index	0	1	2	3	4	5	6	7	8	9	10	11
x	1	9	5	0	8	6	3	5	1	0	2	9

The subroutine **a** in the code below is going to be executed with parameter **b** set to 1 and parameter **c** set to 6.

a) Trace the call of the function **a (1,6)** and show clearly the results of the call. If there are any numerical calculations for which you would need a calculator, just leave them written as a formula.

(8 marks)

	function
1	float a(int b, int c){
2	float d;
3	int e;
4	d = 0;
5	e = b;
6	while(e <= c){
7	d += x[e];
8	e++;
9	}
10	return(d/(c-b+1));
11	}

b) Write a brief summary of what the subroutine does. **(6 marks)**

c) Decide on better names for the identifiers (the subroutine name, its parameters and the variables) and rewrite the code using your new names and include suitable comments.

(10 marks)

d) Rewrite lines 6 to 9 using a for-loop instead of a while-loop. **(6 marks)**

A4

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

```
char compare(int p1){if(p1==2)return '2';
else if(p1==3)return '3';else return '1';}
```

(6 marks)

b) Re-write the code of the function compare using a switch statement instead of the conditionals.

(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) all the different type identifiers.
   iv) a conditional (logical, boolean) expression.
   v)   a conditional statement.

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

(5 x 2 marks)

d) If, by mistake, the programmer wrote (p1=2) instead of (p1==2) how would that change the behaviour of the code?

(8 marks)

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

B5

A company has decided to create a mobile phone application to convert numbers between different bases. Binary numbers are converted to decimal by successively multiplying each binary digit by increasing powers of 2; starting at the least significant bit, as shown in the example below:

$$1011 \text{ (binary)} = (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = 11 \text{ (decimal)}$$

Write an algorithm in pseudocode to input a binary number (most significant bit first) and to output its decimal equivalent. You will need to read in the number of binary digits first.   **(12 marks)**

B6

Briefly define the following terms:

a)	recursion.	**(3 marks)**
b)	decomposition.	**(3 marks)**
c)	linked list.	**(3 marks)**
d)	data type.	**(3 marks)**

B7

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

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)**

B8

Describe the difference between the use of a compiler and an interpreter for translating program source code.   **(12 marks)**

B9

Describe the types of documentation that should be given to a client on completion and hand-over of a software project.   **(12 marks)**

B10

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

a)	data and information.	**(4 marks)**
b)	systems software and application software.	**(4 marks)**
c)	queue and stack.	**(4 marks)**

B11

Describe the following types of test and explain the methods you would use in applying them:

a)	Unit testing.	**(6 marks)**
b)	Acceptance testing.	**(6 marks)**

B12

It is common to take an iterative and incremental approach to software development; this can be called a cyclical model.

a)	Draw and label a diagram showing an iterative and incremental approach to software development.	**(6 marks)**
b)	Briefly explain how the iterative and incremental approach operates.	**(2 marks)**
c)	Describe **ONE** advantage and **ONE** disadvantage of using these techniques for developing software.	**(4 marks)**

END OF EXAM