BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 24th September 2014 – 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 travelling salesman wants a program to calculate the length of routes between towns represented by the letters A-E. Each route is a list of town names to be visited in order; e.g. E,A,C,D,B. Also available is a table of distances between individual towns.

Distances(miles)	A	B	C	D	E
A	0.0	221.2	209.8	244.6	29.2
B		0.0	223.3	48.4	239.0
C			0.0	221.5	229.3
D				0.0	263.1
E					0.0

Describe the data structures that you would use to store this information and write a program that the salesman could use to calculate the length of several possible routes each route being typed in as a list of letters.

You are advised that a structured program using well-chosen functions will obtain the most marks.

(30 marks)

A2

A postal system has a range of prices (£) for different weights (gm) which have been stored in two arrays as follows:

	1	2	3	4	...	10
upToWeight	5.0	10.0	25.0	50.0		
postCost	1.50	2.00	3.00	4.00		

A bookseller stores the book number (ISBN, 13 digit) and weight (gm) of books in two arrays as follows:

	1	2	3	4	...	500
ISBN	9123450870214	...	...	...		
bookWeight	12.49	...	...	...		

A customer has an order expressed as an array called *ORDER* of 10 book numbers and the problem is to find the total postage cost of the order.

Solve the problem by writing the functions:

a) *lookupWeight(bn)* – find *bn* in the *ISBN* array and return the corresponding entry from the *bookWeight* array. **(12 marks)**

b) *findCost(w)* – find the first entry in *upToWeight* which is greater than or equal to *w* and return the corresponding entry from the *postCost* array. **(10 marks)**

c) *orderCost()* – using a) and b), find the total postage cost of the customer's order as stored in the array *ORDER*. **(8 marks)**

A3

The array *a* has been initialized as follows

	0	1	2	3	4	5
a	3	7	5	1	2	7

The function *f* has been defined as follows:

```
int f(){
  int b=0,c,d;
  for(c=0;c<=5;c++)
        for(d=c+1;d<=5;d++)
              if(a[c]==a[d])
                    b++;
  return b;
}
```

a) Trace the call of the function *f*. **(12 marks)**

b) State what you observe to be the effect of *f*. **(8 marks)**

c) Give the function *f* a new name which is more appropriate. **(2 marks)**

d) Using the renamed function, write a function *isSet* which returns 1 if the values in the array form a set (i.e. there are no repeated values) and 0 otherwise. **(4 marks)**

e) Write a more efficient version of *isSet*, not using the original *f* or its renamed version, which can return the 1 or 0 answer more quickly than the *isSet* in part d) **(4 marks)**

A4

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

```
int f(char*v){int i=0;while(i<10){if
(v[i]=='.')return i;i++;}return -1;}
```

(8 marks)

b) What is meant by white space when discussing computer programs? **(4 marks)**

c) Computer programs are normally indented in a consistent way. Explain what this consistent way is and why it is done. **(4 marks)**

d) 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) all the different operators
iv) all the conditional (logical, boolean) expressions
v) a loop statement

[*Note that you should copy out exactly what is requested and no more*] **(5 x 2 marks)**

e) Rewrite the code in part a) using a for loop. **(4 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) plus the number of bits of the binary number and to output its decimal equivalent. **(12 marks)**

B6

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 insertion sort process **(2 marks)**

b) List an advantage and a disadvantage of using the insertion sort approach **(2 marks)**

c) Use pseudocode or actual program code of your choice to specify the insertion sort algorithm **(8 marks)**

B7

Software is often grouped into the following categories: Application Software, Systems Software and Computer Programming Tools

a) Write down the category that each of the following items of software belongs to:

i) Linux OS
ii) Internet Explorer Web Browser
iii) Windows Visual C++ IDE
iv) Dreamweaver Web Design Software
v) Java Interpreter
vi) Mac OS X

(6 marks)

b) Describe briefly the three categories in a way that would help someone work out in which category to place a new piece of software. **(6 marks)**

B8

a) Describe the difference between sequential and parallel programming. **(4 marks)**

b) Describe a problem where parallel programming is useful. What characteristics does the problem possess which makes parallel programming particularly suitable? **(8 marks)**

B9

A web form is to be used to gather information from students applying to a university computing department to join a course. The information required is the name of the student, their gender, which of the subjects mathematics, physics, computing they have studied at school and which degree course they want to study.

a) State which type of form element is appropriate for each piece of information giving a reason. **(8 marks)**

b) Sketch how the final form might look as displayed by a web browser. **(4 marks)**

B10.

Compare the following pairs of terms.

a) Compile-time error and run-time error **(4 marks)**
b) Sequential access file and direct access file **(4 marks)**
c) High-level language and low-level language **(4 marks)**

Note: y*ou are advised that three well-chosen sentences per part 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.

Use the program code below to find occurrences of the following SIX errors listed below.
For each error, you should give the line number and an explanation of the error. In addition, you should state whether each error will be discovered at compile time or run-time.

a) identifier not declared **(2 marks)**
b) type error - index not allowed **(2 marks)**
c) array index out of bounds **(2 marks)**
d) syntax error **(2 marks)**
e) variable required **(2 marks)**
f) type error - invalid type **(2 marks)**

Line	C Program
1	void main();
2	{
3	int x, y;
4	char z[256];
5	w = 1;
6	x = 'w';
7	'w' = y;
8	x = z;
9	if (b > 1 b = b - 1 ;
10	x[0] = y;
11	x = 0;
12	while(x < 9) {
13	z[x-1] = x / y;
14	x++;
15	}
16	}

B12

Briefly describe the operation of the following methods for software development and the particular advantages of using them.

a) Traditional waterfall method **(6 marks)**
b) Software prototyping **(6 marks)**