BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 28th September 2016 - 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) Given an array V containing experiment readings, write a function **findIndex**() to find the index of the first run of 3 readings that are identical. For example in the array V below the first run of three identical values starts at index 2 so the result required is 2.

[Note: If a run of three is not found, the function should return -1]

index	0	1	2	3	4	5	6	7	8	9
V	3	9	7	7	7	1	5	5	5	5

(10 marks)

b) Incorporate your function into a complete program that prints not only the index of the run of three but the repeated value as well. So using the array V above output would be 2, 7.

(8 marks)

c) Write a function **findRun**(n,r) that can take 2 parameters (n=the length of the array and the r=length of the run of identical values) and returns the index where the run is found. So, using the array V above, findRun(10,4) would return 6.

(12 marks)

A2

In a certain game played with cards, a player is dealt a hand of seven cards.

Each card has a value (Ace(one), Two, Three, Four, Five, Six, Seven, Eight, Nine, Ten, Jack(eleven), Queen(twelve) or King(thirteen)) and each card has a suit (Clubs(one), Diamonds(two), Hearts(three) or Spades(four)). A "run of three" requires a consecutive sequence of three values from the value list (e.g. "Four, Five, Six" or "Ten, Jack, Queen") in the hand of seven cards. In addition a "run of three" requires the three cards to be all of the same suit. So for example Ten of Hearts, Jack of Hearts, Queen of Hearts is a "run of three" in the suit Hearts.

A single card can be represented by a pair of numbers (V,S). The first number V (in the range 1 to 13) represents the Value and the second number S (in the range 1 to 4) represents the Suit.

So a hand of seven cards can be represented by two arrays

Index	1	2	3	4	5	6	7
V	4	3	4	10	2	10	8
S	1	1	3	4	1	2	3

In this hand of seven cards, the "run of three" is (2,1) the "Two" of "Clubs", (3,1) the "Three" of "Clubs" and (4,1) the "Four" of "Clubs".

You should assume the two arrays V and S are already declared and set up with values.

a) Write a function, int **InHand**(int v, int s), which returns 1 (TRUE) if a card of value *v* and suit *s* exists in the seven cards defined by the arrays V and S or 0 (FALSE) otherwise.

(10 marks)

b) Using the function **InHand** from part a), write a program to find out whether a given hand of seven cards contains a "run of three".

The output from the program should be either a message saying "Run of three not found" or a listing of the three cards in sequence (e.g. Two of Clubs, Three of Clubs, Four of Clubs).

(20 marks)

A3

a) Trace the behaviour of the call *f*() when *f* and V are defined as shown below.

index	0	1	2	3	4	5
V	4	2	5	6	1	3

```
int f(){
      int g=V[0];
      for(var h=1;h<6;h++){
            g+=V[h];
      }
      float i=g/6;
      float j=V[0]-i;
      for(var k=1;k<6;k++){
            if(V[k]-i>j)
                  j=V[k]-i;
      }
      return j;
}
```

(14 marks)

b) Describe in a single sentence the overall effect of the function *f*.

(6 marks)

c) Rewrite the function changing all the identifiers to make the code more readable and understandable and add suitable comments.

(10 marks)

A4

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

```
void x(char y){int z=10;while(z--)printf("%c",y);}x('-');
```

(6 marks)

b) By adding to your answer for a) or writing out again, show where in the code there is

i) a function declaration
ii) a formal parameter
iii) a function call
iv) an actual parameter

(4 x 2 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 operators
iv) an iterative (repetitive, loop) statement
v) the statement that is repeated by the loop

(5 x 2 marks)

d) Write out the code from a) again, this time replacing the loop with an equivalent for loop.

(6 marks)

B5
Write a function Power (P, N) in pseudocode (or a program in a language of your choice) in which the integer value of 'P' is raised to the integer power of 'N'.

   a) Using recursion   (6 marks)

   b) Using iteration   (6 marks)

B6
A palindrome is a word, or a sequence of characters, that reads the same backwards as forwards, such as *madam* or *radar.*

a) Write a pseudocode function "palindrome" which takes as its parameters a character array and which returns "TRUE" if the array contains a palindrome otherwise returns "FALSE".

                                                          (8 marks)

b) Trace through the code for the inputs: "rotator" and "notion".

                                                          (4 marks)

B7
Consider the function **min** (see box below).

   a) How would a black-box test of the function **min** be performed?
                                                           (3 marks)
   b) How would a white-box test of the function **min** be performed?
                                                           (3 marks)
   c) In what way would the error in the function show up under black-box testing using the test case **min**(4,2,3)?

                                                           (3 marks)

   d) In what way would the error show up under white-box testing using the test case **min**(4,2,3)?
                                                           (3 marks)

```
int min(int a, b, c){
/* specification: find the minimum of 3 values given as parameters */
int min; /* hold the minimum value found so far */
        min=a;
        if(b<a) min=b;
        if(c<a) min=c;
return(min);
        }
```

B8

a) Using an algorithm, describe the operation of a queue.   (9 marks)

b) A queue contains the values 7, 6, 9 where 7 is the first value stored and 9 is the last.
   List the final values in the queue after the following operations are made:
   1. Pop
   2. Pop
   3. Push12
   4. Push 16
   5. Pop
   6. Push 11   (3 marks)

B9

A business selling to the general public, via a web site, requires their site to have a good user interface design.

a) List the basic web elements that could be used so the user can interact / enter data
                                                                           (6 marks)

b) Briefly describe what you consider to be the basic concepts of good user-interface
   design?   (6 marks)

B10

Compare the following pairs of terms.

   a) Source code and object code   (4 marks)
   b) Text files and binary files   (4 marks)
   c) Open source and closed source software   (4 marks)

B11

a) The Rapid Application Development (RAD) methodology was developed in response to
   the need to deliver systems fast. Describe how the following management procedures are
   used to support this approach:

   i) Prototyping
   ii) Incremental Development
   iii) Time-Boxing   (3 x 2 marks)

b) Briefly discuss the benefits and limitations of adopting the RAD methodology to develop
   software.   (6 marks)

B12

Consider the design and implementation of the search facility in a text-editor. During the process a specification will be drawn up, sometime later an algorithm will be produced and documentation will be written. With reference to this example, write brief notes on what you understand by the following terms:

   a) Specification   (4 marks)
   b) Algorithm   (4 marks)
   c) Documentation   (4 marks)