

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 26th September 2012 - 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.

When you are asked to write code, please state the language you are using.

SECTION A

Answer TWO questions out of FOUR in Answer Book A. Each question carries 30 marks

- A1. An array called *correct* contains the correct values for eight measurements. The array *experiment* contains the values obtained by students for the same measurements. The array *result* contains the marks awarded for their attempts. If an experimental result is within 1% of the correct value the score is 8, if the result is within 10% then it scores 4, otherwise 0.

	0	1	2	3	4	5	6	7
correct	100.0	200.0	50.0					

	0	1	2	3	4	5	6	7
experiment	100.5	215.0	80.0					

	0	1	2	3	4	5	6	7
result	8	4	0					

- a) Write code to calculate the values in array *result* assuming the arrays *correct* and *experiment* exist and contain values
(8 marks)
- b) Convert the code you have written for part a) into a function (or procedure) called *marking* which has 4 parameters *high*, *tight*, *low*, *loose*. *High* and *low* are the scores awarded (c.f. 8, 4) and *tight* and *loose* are the percentage differences allowed (c.f. 1%, 10%)
(8 marks)
- c) Write a function to find the sum of the values in the *result* array, expressing it as a percentage of the maximum score possible.
(6 marks)

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- d) Write a program using your answers to b) and c) which reads 8 values into the array *correct* from one file, 8 values into the array *experiment* from another file and computes the percentage of the maximum score. **(8 marks)**

- A2. A University department wants to award a prize to the most improved student. This means the student who improved their average mark the most in the second year compared with the first.

Students take 12 courses each year and the marks are percentages, rounded to integer. The actual data is available in two text files called year1 and year2. Each line in a file corresponds to one student and lists their 12 results. There are 50 students in the class and the students are in the same order in both files. You can assume no two students have the same name.

The programming task is to read both files and calculate the year1 and year2 average for each student and hence print out the position of the most improved student. This will be a number - for example 10 would mean that the student listed 10th in the files is the most improved.

(30 marks)

- A3. Consider the following function that has been created as part of a sorting program

```
void bubble(int n){
    int i;
    for(i=1;i<n;i++){
        if(v[i-1]>v[i]){
            v[i-1]=v[i];
            v[i]=v[i-1];
        }
    }
}
```

- a) If the array v has been initialised as follows, trace the function call bubble(8)

	0	1	2	3	4	5	6	7
v	9	7	5	3	2	4	6	8

(16 marks)

- b) The student who wrote this function was trying to create a component of a sorting program. What has gone wrong? Correct the mistake that you have pointed out.

(6 marks)

- c) Using your corrected version of bubble, go on to create a function sort that can fully sort the array v into ascending order.

(8 marks)

A4. Consider the following program and answer the questions that follow

```
int a;
int b(int c){
    int d, e=0;
    if(c<0)c=-c;
    for(d=0;d<=c;d++)
        e=e+d*d;
    return(e);
}
void main(){
    a=b(100);
}
```

In the program above find and copy out all the (different)

- a) local variables
- b) function identifiers
- c) arithmetic operators
- d) integer constants
- e) type identifiers
- f) punctuation characters
- g) reserved words
- h) relational operators

(9 x 2 marks)

Notes: In parts (a-h) only copy out what is asked for - do not include any of the surrounding context. If an item occurs more than once in the program then it is only necessary to write it down once.

From the program above, find and copy out one example of

- i) a logical/boolean expression
- j) an iterative statement
- k) a conditional statement
- l) a function call

(4 x 3 marks)

SECTION B

Answer FIVE questions out of EIGHT in Answer Book B. Each question carries 12 marks.

- B5. a) An array called *binary* representing a number in binary has been created. Write a function called *decimal* to calculate and return the corresponding decimal integer.

index	0	1	2	3	4
binary	1	1	1	0	1

The result of calling the function *decimal* with the array above is 29

(6 marks)

- b) Write a test program to test your function which reads in digits into the array, calls your function and outputs the result.

(6 marks)

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- B6. By writing two functions called `fibonacci` and `fibonacci_r` show how the calculation known as the fibonacci sequence may be computed by an non-recursive method and a recursive method.

[Definition: `fibonacci(n)`
 is 1 if $n=0$,
 is 1 if $n=1$,
 is the sum of fibonacci for $n-1$ and fibonacci for $n-2$ if $n>1$]

(2 x 6 marks)

- B7. Carry out the following programming tasks

- a) Write a for loop equivalent to the following code

```
i=100; while(i>0){ f(i); i-- }
```

- b) Rewrite the following conditional without using the logical operators 'and' (&&), 'or' (||), 'not' (!)

```
if( !p || q ) x=1; else x=0;
```

- c) Write the code to perform a left cyclic shift of the values in array `v` below

index	0	1	2	3	4
v (original)	'S'	'M'	'I'	'L'	'E'
v (after shift)	'M'	'I'	'L'	'E'	'S'

(3 x 4 marks)

- B8. Consider the following code:

```
int v[8];int f(){int i,j,k;j=v[0];for(i=0;i<8;i++)if(v[i]<j)j=v[i];k=v[7];for(i=7;i>=0;i--)if(v[i]>k)k=v[i];return k-j}
```

- a) Why does this code look unusual?
(2 marks)
- b) Rewrite it to make it look more conventional.
(4 marks)
- c) Could the original 'bad' code run successfully without the change you made in b)? Why?
(2 marks)
- d) Explain in your own words what the code is trying to achieve
(2 marks)
- e) Apart from what you did in b), suggest one more improvement to the code
(2 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. Supply the words to complete the following sentences:

a) Two popular methods of searching are ____ & ____.

b) The binary system operates in base ____ whereas the hexadecimal system operates in base ____.

c) The acronyms ROM and RAM stand for ____ & ____.

d) Computer memory is usually measured in units of ____ while processor speed is measured in ____.

e) In a program the parts introducing new identifiers are called ____ and the parts only intended to be read by the human reader are called ____.

f) Run time errors can be found in code by using a ____ which installs ____ at selected points.

g) Two diagrammatic notations used in the design of programs are ____ & ____.

h) Whitespace is any selection of program text made up of ____, ____ & ____.

i) The alternative names for the data structures called LIFO and FIFO are ____ & ____.

j) The last two phases of the software development life cycle are ____ & ____.

k) Two ways to obtain a one-from-many selection from the user on a web form are ____ & ____.

l) An example of a procedural language is ____ and an example of an object-oriented language is ____.

(12 x 1 mark)

B11. a) Name two algorithms that can be used for searching for data in an array.

(2 marks)

b) For EACH algorithm that you named in a), briefly describe how the algorithm works

(2 x 5 marks)

(Note: no code is required)

B12. a) In what circumstances is a record used in a computer program?

(4 marks)

b) By using a simple example in a programming language of your choice describe:

i) how a record is created

ii) how the values of a record are accessed

(4 marks)

c) Go on to show how a collection of similar records can be created and accessed

(4 marks)

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*** END OF EXAM ***