

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

SOFTWARE DEVELOPMENT

Wednesday 25th March 2015 - 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 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 A containing 100 different numbers and a variable S containing a single number, write a program to find out if the number in S appears anywhere in A.
(8 marks)

- b) Using your ideas from a), write a function called MEMBER which takes A, S, LOW, HIGH as parameters and returns *TRUE* if S is in array A, at any index from LOW to HIGH, and *FALSE* otherwise.
(8 marks)

- c) Now consider the situation where there are two arrays one with 100 elements called AVAILABLE and one with 10 elements called SELECTED. Write a program which checks that all the elements of SELECTED are different and also that all the elements of SELECTED also appear in AVAILABLE.
(14 marks)

[Turn Over]

A2

In a game of dice called Yahtze a player rolls 5 dice and then is given a score depending on the pattern of numbers on the tops of the dice. Each dice has six sides bearing the numbers 1 to 6. So the result of a throw of the 5 dice can be represented by 5 numbers in the range 1 to 6 and the 5 numbers can be stored in an array. So for example the THROW 2,6,3,6,2 can be stored like this:

	0	1	2	3	4
THROW	2	6	3	6	2

A program is required to calculate the score from the THROW as follows

50 points for "all-the-same" (5 of a kind) e.g. 4,4,4,4,4

30 points for "4-the-same" (4 of a kind) e.g. 3,4,3,3,3

25 points for "3-the-same and 2-the-same (3 of a kind and a pair) e.g. 5,1,5,5,1

otherwise the score is the sum of the numbers

It may be useful to compute another array of numbers being the count of the times each number occurs in THROW.

	1's	2's	3's	4's	5's	6's
COUNT	0	2	1	0	0	2

By computing this auxiliary array COUNT (or otherwise) write a program to calculate the Yahtze score. **(30 marks)**

A3

Consider the following program

```
void F(int G,int H){
    int J;
    for(J=0;J<=5;J++){
        if(G<V[J] || V[J]<H) V[J]='Y'; else V[J]='N';
    }
}
```

	0	1	2	3	4	5
V	7	6	5	4	3	2

a) With the array V having values as shown in the diagram, trace the call of F(3,5) **(14 marks)**

b) If the intention had been to turn elements that lie strictly between G & H into 'Y' and all others into 'N', how would you change the code? **(4 marks)**

c) Write a function capable of classifying an array of characters (S) so that any Uppercase letter is changed to U, any Lowercase letter to L, any Digit to D and anything else to O as in the example below:

	0	1	2	3	4	5	6	7	8	9
S(initial)	T	i	m	e		3	p	.	m	.
S(final)	U	L	L	L	O	D	L	O	L	O

(12 marks)

A4

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

```
int a(int b){int c,d;d=0;for(c=10;c>b;c--)d=d+1;return(d);}
```

(6 marks)

b) The identifiers in the program above are particularly short.

- i) What rules do modern programming languages require a programmer to follow in choosing the characters that make up a valid identifier?
- ii) Out of all the possible valid identifiers that a programmer can use, how does the programmer normally go about choosing a 'good' identifier? **(2 x 4 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) a conditional (logical, boolean) expression
- 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 a while loop. **(6 marks)**

SECTION B

Answer 5 questions (out of 8). Each question carries 12 marks.

B5

Conversion of a decimal number to its binary equivalent is carried out using the following technique:

The decimal number is successively divided by 2 and the remainders are stored. The remainders in reverse order form the binary number; the last remainder being the most significant digit. In the example below 19 (decimal) = 10011 (binary)

Process	Quotient	Remainder
÷2	19	1 (least significant bit)
÷2	9	1
÷2	4	0
÷2	2	0
÷2	1	1 (most significant bit)
	0	

Write pseudocode or a program in a language of your choice in which a decimal number is input and its binary equivalent is output. Only positive integer decimal numbers are to be considered.

(12 marks)

[Turn Over]

B6

Testing strategies are an important part of software development.

- a) Describe the term *dry run* testing. (2 marks)
- b) Describe the concept *white box* testing and discuss the limitations of using this technique. (6 marks)
- c) Discuss the skills that will be needed to implement *white box* testing successfully. (4 marks)

B7

- a) Explain the term Random Access. (4 marks)
- b) Give two examples of commonly used Random Access computer devices. (4 marks)
- c) Give details of a situation in which a Random Access file would ideally be used. (4 marks)

B8

- a) Name two algorithms that can be used for sorting an array. (2 marks)
- b) Choose ONE of the algorithms named in a) and describe how it works. (10 marks)
(Note: code is not required)

B9

Supply the words to complete the following sentences:

- a) The binary system operates in base 2 and uses digits the 0 to 1, whereas the octal system operates in _____ and uses the digits _____.
- b) Two popular methods of _____ are Binary Chop and _____.
- c) Microsoft Windows 8 is an example of _____ software and Visual C++ IDE is an example of _____ tools.
- d) Two phases of the software development life cycle that follow design are _____ and _____.
- e) The acronym OOP stands for _____.
- f) A compiler is a program that translates _____ code into _____ code.
- g) In a program _____ are included for the human reader, to help them _____ the code operation.
- h) The basic control structures used in computer programs are _____, selection and _____.
- i) _____ is an important part of programing and is used to detect the _____ errors that cannot be detected by the compiler.
- j) Two popular methods of testing programs are _____ and _____.
- k) An example of a procedural language is _____ and an example of an object-oriented language is _____.
- l) Two kinds of buttons that tend to occur in groups on web-based forms are _____ and _____.

(12 x 1 mark)

B10

Compare the following pairs of terms.

- a) Stacks and queues (4 marks)
- b) Sequential and parallel programming (4 marks)
- c) System software and application software (4 marks)

Note: You are advised that three well-chosen sentences per pair 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 i,j;
4	float v[10];
5	i=1;
6	j=i[2];
7	k=i+j;
8	if(i>1 i=i-1;
9	v[0]=i;
10	if(v[0])j=1;
11	for(i=0;i<=9;i++)
12	v[i+1]=i;
13	5=i;
14	}

B12

A web designer for an online sales company has to create a web page for a new user to register for the organisation; the page should contain the following interface elements:

- i) a method for the new user to enter their name
- ii) a technique to enter the age of the user, for example: 0-15, 16-35, 36-55 etc.
- iii) a method to enter the gender of the user
- iv) a method for the user to show a combination of methods by which they are willing to be contacted (for example: phone, email, letter)
- v) a method to enter the completed registration form details onto the system

Sketch a form to illustrate your ideas for this interface. The page should contain a form with appropriate elements to handle the various types on information. (12 marks)