BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Friday 22nd April 2022 - 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

Write code which uses an array to implement a stack of nonnegative (i.e. greater or equal to zero) integers. Your code should implement the following functions:

stackEmpty
Returns **true** if the stack is empty or **false** if it is not.

stackFull
Returns **true** if the stack is full or **false** if it is not.

push
Accepts an integer parameter. Adds the value to the stack and returns the value of the parameter if successful. If the stack is full or the parameter is a negative integer, returns -1.

pop
Returns the value at the top of the stack. Returns -1 if the stack is empty.

Your answer should include code which tests that each of the four functions is working correctly.

(30 marks)

A2

a) State **FOUR** advantages of using functions in programming.

(8 marks)

b) Write a function “MultiplicationTable()” in pseudocode. The function should create and display a multiplication table for a given number provided by the user.

(10 marks)

c) The repetition of a computational procedure can be achieved via ‘iteration’ or ‘recursion’.

Explain **both** terms and discuss why a programmer writing in an imperative programming language might prefer to use iteration rather than recursion.

(12 marks)

B12

Explain the main similarities and differences between the following three pairs of software terms:

i) Elementary types vs Derived types
ii) Linked List vs Array data structures
iii) Cloud storage vs Local storage.

(12 marks)

End of Examination

B9

Software reuse is the process of creating software from existing software rather than developing software from scratch.

a) Briefly describe how software reuse can benefit software development.

(8 marks)

b) What are the characteristics of a piece of software that make it suitable for reuse in an existing software project?

(4 marks)

B10

Establishing a software requirements specification (SRS) involves gathering the 'functional' and 'non-functional' requirements of a new software product.

a) In which phase of the traditional Software Development Life cycle (SDLC) would the SRS be produced?

(2 marks)

b) Explain why both functional requirements and non-functional requirements are necessary in an SRS.

(4 marks)

c) Describe **THREE** typical non-functional requirements that may affect the quality of a software product.

(6 marks)

B11

a) Online shopping/e-commerce web sites often present content in the form of images, showing a range of products that can be viewed and purchased using any device that connects to the World Wide Web; for example: tablet, smartphone, laptop, large screen PC.

Explain from a design point of view why it is desirable to have a responsive user interface when users browse a web site using a variety of devices.

(6 marks)

b) Explain how you would adapt the design of a user interface to accommodate **each** of the following restrictions or impairments:

- Visual impairment: someone with poor sight who struggles to read.
- Restricted cognition: someone who is unable to read text; maybe too young or with some disability.
- Physical impairment: someone who is unable to type and use a keyboard.

(6 marks)

A3

a) Write code which finds the largest number in an array of integers and prints it out.

(10 marks)

b) Amend the code you produced for part a) so that it prints out the **TWO** largest numbers in the array. For example, if the array contains 11, 97, 23, 37, 30, the program will output 97, 37. Assume that the array will contain at least two values and that no value is duplicated.

(10 marks)

c) Write code which operates on an array of integers containing one duplicate entry and prints out the value that is duplicated. For example, if the array contains 11, 37, 23, 37, 30, the program will output 37. Assume that the array will contain at least two values.

(10 marks)

A4

Describe **each** of the file storage structures listed below. For each file type, give an example of an application which might use the file type and explain why it is useful in this context:

i) Sequential file
ii) Index-sequential file
iii) Random-access file
iv) Text file
v) Comma Separated Value (CSV) file.

(30 marks)

[Turn Over]

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

B5

Consider the following very simplified description of a 'Hashing algorithm'.

Hashing is a method of storing and retrieving records from a database based on a key value.

An indexed collection of key values is stored in a hash table. Fig B5.1 below shows an example of a hash table consisting of 10 rows with key values 11, 17, 23, 8, 3 hashed and sorted in index order.

Fig B5.1 Example of a populated hash table

Index	Key Value
1	11
2	
3	23
4	3
5	
6	
7	17
8	8
9	
10	

Note that hash tables are initialised with a fixed number of rows that exceed the number of key values to be hashed.

An index value is computed by a 'hash function' that returns the remainder of modulo (integer) division between the key value and the total number of rows in the hash table.

For example, using a key value of 11 on the table Fig B5.1 above would be computed as follows:

```
11 % 10 = 1
```
(Index = 1 because 1 is the remainder of modulo (integer) division)

(Note: "%" is the symbol for modulo (integer) division)

A collision occurs when two keys hash to the same index value. When this happens the second key is placed in the next available slot in the index.

a) Write out the contents of a hash table containing 8 rows given the following key values:

12, 19, 21, 8, 4, 16

Show your working out.

(5 marks)

b) Write a function called ModHash() that returns an index value for a given key value using modulo division.

(3 marks)

c) Briefly explain the process of searching for a particular key in a hash table.

(4 marks)

B6

a) Draw a flow chart for a program that inputs a temperature into a variable Temp and prints a message that depends on the temperature that is recorded.

Temperatures greater than 50, print *Danger too hot".
Temperatures greater than 35 and up to 50, print "Very hot"
Temperatures greater than 20 or equal to 20 and up to 35, print "Perfect".
Temperatures greater than -5 and up to 20 print "Cold".
Otherwise, the program ends and prints an error in input.

(6 marks)

b) Translate your flow chart into a subroutine called CheckTemp().

(6 marks)

B7

a) What is the difference between 'system software' and 'application software'?

(3 marks)

b) State the differences between application software that is 'open source' with application software that is 'closed source'.

(3 marks)

c) Give an example of a type of application where users can choose either open source or closed source software.

(2 marks)

d) Explain what factors should be considered when choosing between open source and closed source application software.

(4 marks)

B8

Suppose you are a team leader for 20 programmers. The team of programmers work on a large project with each programmer given an individual programming task to complete. You are accountable to a Project Manager who manages the entire project and delivers the final product to a client.

a) Describe a range of documentation that should be given to you by the Project Manager prior to development.

(4 marks)

b) Explain how you would use this documentation to prepare your team of programmers to carry out the development phase of the project.

(5 marks)

c) List the documentation that each programmer should produce on completion of their programming task.

(3 marks)

[Turn Over]