BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 11th November 2020 - 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) in Answer Book A. Each question carries 30 marks.

A1.

a) What is pseudocode and how is it used in software development? Your answer **SHOULD** include an example showing the features you would **TYPICALLY** expect to find in a piece of pseudocode.

(10 marks)

b) Write pseudocode for a program that sets a variable named username as "MyUserName" and another variable named password as 'MyPassword' then asks the user to enter the username and password. If the correct username and password are entered the program should display "Logged in" otherwise the program should display either "Incorrect Password" or "Incorrect Username" as appropriate. It should also allow the user to make another attempt at entering the correct combination. The user should be allowed a maximum of **THREE** attempts to get the correct password.

(10 marks)

c) Consider an investment plan where a fixed amount is invested at the beginning of each year of the plan and an amount of interest is added at the end of each year. The interest rate is fixed throughout the duration of the plan.

For example, if the amount invested each year is £10 and the interest rate is 10% then the following table contains details of the account over 3 years:

Year number	Balance at start of year	Interest paid	Balance at end of year
1	10	1	11
2	21	2.1	23.1
3	33.1	3.31	36.41

Write pseudocode for a program to calculate the value of the investment at the end of each year for a given number of years. The inputs to the program will be the yearly investment, the interest rate, and the number of years for the investment. The output will be the value of the investment at the end of each year; so, if seven years are being considered there will be seven lines of output.

(10 marks)

A2.

The examination scores for a number of students are stored in a two-dimensional array (Python programmers might call this a "list of lists"). The array contains **FOUR** elements related to each student. The **FIRST** element contains the student's name. The remaining three store examination marks for three separate examinations. The information stored in the array is shown in the following table:

Name	Examination 1	Examination 2	Examination 3
Steve	55	60	75
Mike	75	85	90
Paul	71	78	78

a) Write a program to search the array to find the results for a given student. The program should obtain the student's name from the user then search for it in the array. If it is found the results for that student should be displayed. If the student name is **NOT** found the user should be informed that no results have been recorded for that student.

(10 marks)

b) Write a program that accesses each student in the two-dimensional array, adds up the marks they have obtained for the **THREE** exams then displays their total marks before moving on to the next student.

(10 marks)

c) Assume that the content of the two-dimensional array has been sorted alphabetically by student name. Explain how a binary search algorithm might be used to search for a specific student name. Illustrate your answer using some sample data. It is **NOT** necessary to provide code.

(10 marks)

A3.

a) Write a function that takes the length (l), width (w) and height (h) of a three-dimensional shape as arguments then returns the volume of the shape by multiplying them together (l * w * h). Write code showing how the function can be called from within a program.

(10 marks)

b) A road traffic authority has devised a scheme to fine drivers who exceed a speed limit. The fine is £50 plus £5 for each kilometre-per-hour exceeding the specified limit plus a penalty of £100 for any speed over 90 kilometres per hour. Write a function that accepts a speed limit and a measured speed and returns the amount of the fine that should be charged. If the speed limit has **NOT** been exceeded the value returned should be zero.

(10 marks)

c) Explain what is meant by the term "object" as used in object oriented programming. What role do functions play in the implementation of objects? Illustrate your answer with examples based on the scenarios described in part a) and b) of this question.

(10 marks)

[Turn Over]

A4.

a) Compare and contrast the following pairs of concepts related to software development:

i) Application Software vs. System Software;
ii) Algorithm vs. Program;
iii) High-Level Language vs. Machine Language;
iv) Interpreter vs. Compiler;
v) Syntax vs. Semantics.

(15 marks)

b) Identify and briefly describe **FIVE** distinct steps in the software development process.

(15 marks)

SECTION B
Answer 5 questions (out of 8) in Answer Book B. Each question carries 12 marks.

B5.

A factor is a number that divides into another number exactly without leaving a remainder. For example, the factors of 24 are 1,2,3,4,6,12 and 24. Two numbers may share the same factors. For example, 24 and 54 have common factors of 1,2,3 and 6, with 6 being the Greatest Common Factor (GCF).

a) Write an algorithm that will find the Greatest Common Factor (GCF) of **TWO** positive whole numbers.

(6 marks)

b) Express your algorithm as a function called GCF in a programming language of your choice or in pseudocode.

(6 marks)

B6.

Choose a sorting technique in which you are familiar to answer parts a) and b) of this question.

a) Describe your chosen sorting technique showing each stage of processing required to sort the following array into descending order (highest to lowest numerical value).

Array{14, 33. 25, 10, 35,19, 42}

(6 marks)

b) Explain your sorting technique in program code using either pseudocode or a programming language of your choice.

(6 marks)

B7.

a) Many organisations develop software they require “in-house”, meaning that they resource the development using their own teams of programmers and support an IT infrastructure.

Describe the advantages and disadvantages of **EACH** of the following approaches as alternatives to “in-house” development:

i) Outsourcing the development;
ii) Purchasing a bespoke software package.

(8 marks)

b) What is meant by the term “hosting on the cloud”? Explain how it is associated with outsourcing.

(4 marks)

[Turn Over]

B8.

Write short notes on **EACH** of the following pairs of related programming terms, highlighting any differences between them:

a) Recursion and Iteration;
b) Object Oriented Programming and Modular programming;
c) Functions and Procedures.

(12 marks)

B9.

Refer to the following program written in C.

```
#include <stdio.h>int main(){int m=40,n=20;
int o=20,p=30;if (m>n && m !=0){
printf("&& condition1\n");}if
(o>p || p!=20){printf("||condition2\n");
   }if (!(m>n && m !=p)) {
 printf("!: condition3\n");}
}
```

a) Rewrite the code to improve the layout and structure of the code to make it easier to read.

(3 marks)

b) Calculate the result of executing the code. Explain your answer.

(9 marks)

B10.

A file called carsales.dat stores text data about car sales. A sample of data is as follows:

Description	Data sample
RegNumber	YW67 XAR
Make	Audi
YearofManufacture	2006
Date purchased	13/10/2019
PurchasePrice	£3889.00
BalancePaid?	YES

a) Provide an example of **EACH** of the following properties present in the above data file:
   i) Record;
   ii) Field;
   iii) Boolean Data Type.

(3 marks)

b) Give **FIVE** operations on data files that are supported by most programming environments.

(5 marks)

c) Compare and contrast a binary file with a data file.

(4 marks)

B11.

Suppose a new software product is being developed for a small business by **TWO** programmers.

a) Explain in no more than **TWO** sentences why documentation of software is important.

(2 marks)

b) Briefly describe the type of internal documentation that **SHOULD** be produced by a programmer developing the software product.

(3 marks)

c) Briefly describe the type of external documentation that a programmer **SHOULD** produce for the users of the software product.

(3 marks)

d) Explain the sources of information that are required to produce **EACH** of the above types of documentation.

(4 marks)

[Turn Over]

B12.

Web based interactive forms contain a range of interface elements that are suitable for the user to enter data.

Imagine you are required to design a user interface in which users input the following details about a set of photographs that had been previously uploaded and individually selected:

a) The name(s) of the selected image(s) that the description applies;
b) The camera model and the lens that was used;
c) Where and when the image was taken;
d) The type of camera used, selected from a range of options;
e) The supporting equipment used. For example, any of these: *Tripod, Filter, Lens Extension.*

Draw a single screen that includes all the user interface controls needed to support the requirement given above.

Note: It is not necessary to draw a complete web page, only show the basic controls such as text boxes, drop downs, buttons etc.

(12 marks)

End of Examination