BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Friday 4th October 2024 - 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 any <u>Section A</u> questions you attempt in <u>Answer Book A</u>
Answer any <u>Section B</u> questions you attempt in <u>Answer Book B</u>

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.

You are tasked with designing a program to calculate the average score of students in a class. The program should take the number of students as input, and then prompt the user for the scores of each student. After collecting the scores, the program should calculate and display the average score.

a) Design the algorithm for this program using pseudocode. Ensure that your pseudocode includes clear steps and logical structures.

(12 marks)

b) Present the algorithm in a flowchart using appropriate symbols and annotations to represent the key elements of your algorithm.

(10 marks)

c) Modify your pseudocode from a) to incorporate error handling into your algorithm. If a user enters an invalid score (e.g., a non-numeric value or a score outside the valid range), the program should provide an error message and prompt the user to enter the score again.

(8 marks)

A2.

Each of the following emerging technologies will have an impact on the future of software development. For **each** technology, discuss the potential benefits, challenges, and implications for software development:

i. Artificial Intelligence/Machine Learning.

(10 marks)

ii. Parallel Computing.

(10 marks)

iii. Quantum Computing.

(10 marks)

B12.

Explain in detail the following file access methods:

i. Sequential file access.
ii. Direct file access.
iii. Indexed file access.

Your answer should include diagrams, examples of use, and relative advantages of **each** method.

(12 marks)

END OF EXAMINATION

B9.

A function called countdown(n) takes a positive integer (n) as an argument and prints and decrements n by 1 repeatedly until n= 0.

Thus, calling countdown(4) would count down from 4 down to 0 in 5 iterations.

    a)   Write a version of function countdown(n) (using pseudocode or actual code) for **each** of the techniques:

        i.   Iteration (using loops).
        ii.   Recursion.

                                      (8 marks)

    b)   Discuss the pros and cons of using recursion over an equivalent iterative solution.

                                        (4 marks)

B10.

    a)   Explain the term dry run testing.

                                        (4 marks)

    b)   Explain the terms unit testing and test cases and justify why there is a close association between them.

                                        (8 marks)

B11.

Describe **each** of the following object-oriented concepts. Provide an example of **each** concept with reference to the data about patients given below (Table B11 Patients).

- An object.
- A class.
- A method.
- An attribute (also known as a property).

Table B11 Patients

NInumber(Key)	PersonName	DateAdmitted	DateOfBirth	Age*
2434-3009	Choudry	12/5/2023	13/4/2020	19
5893-5630	Mason	30/5/2023	5/6/1978	45

*Note: Age is a calculated using ((TodaysDate) – (DateOfBirth)).
Assume TodaysDate=1/6/2023

                                      (12 marks)

A3.

The following questions relate to the way programming languages support data types. You should illustrate your answers by presenting code written in a language of your choice.

    a)   Identify and describe **four** common data types and explain how they are declared in your chosen programming language.

                                        (8 marks)

    b)   Explain the difference between static typing and dynamic typing. You should illustrate your answer with code examples written in a programming language of your choice.

                                        (8 marks)

    c)

        i.   Explain how programming languages handle implicit and explicit type conversion.

                                        (5 marks)

        ii.   Provide examples of **three** situations where type conversion would be necessary.

                                        (9 marks)

A4.

    a)

        i.   Define system software and explain its fundamental role in a computer system.

                                        (8 marks)

        ii.   Identify **four** key functions supported by system software.

                                        (4 marks)

    b)   Discuss **three** specific responsibilities of an operating system (OS) in managing computer resources and facilitating the execution of application software.

                                        (6 marks)

    c)   Identify **four** utility programs that are part of system software and describe their respective functions.

                                        (12 marks)

[Turn Over]

B5.

A Taylor Series is an infinite series of terms that when summed together approximate a given mathematical function.

The following Taylor Series approximates the exponential function e^x:

$$\sum_{n=1}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x3}{3!} + \frac{x4}{4!} + \cdots.$$

Where n! represents the factorial of n, for example 3! is the factorial of 3 = 3 x 2 x 1 = 6.

The accuracy of the result depends on the number of terms evaluated.

The result of computing e^1 using only the first 4 terms of the series is calculated as follows:

e^1 = 1+1+1/2 + 1/6 = 1+1+0.5+ 0.16667 = 2.6667

a) Write a function (using pseudocode or actual code) that returns the value of e^x where x is an integer and the number of terms is limited to 20. You can assume a function to compute the factorial is provided.

(7 marks)

b) The actual value of e^x can be computed using a library function that is provided in most programming languages.

Modify your function so that the computation stops when the difference between the value computed above in part a) compared with the value computed using the library function is less than 0.0005.

(5 marks)

B6.

A Software Requirements Specification Document (SRSD) serves as a written specification of customer/client requirements. It states what the developer understands is required and what the proposed software is expected to achieve.

Assume a new software product is required to replace a manual system.

a)
  i. State **three** techniques that a software developer would use to elicit software requirements directly from the customer/client.

  ii. Explain how these techniques assist in understanding what the customer/client requires.

(6 marks)

b) Make a list of the **key** components of what a SRSD should contain once the software requirements have been undertaken.

(6 marks)

B7.

a) Name **two** different search algorithms that are used to locate a particular item of data stored in an array.

(2 marks)

b) Explain how **both** of the search algorithms you named above work. You should use pseudocode or diagrams to support your explanation.

(8 marks)

c) What is meant by "the Big O" in the context of searching?

(2 marks)

B8.

a) Define the data structure known as a QUEUE.

(2 marks)

b) List and describe **five** operations that can be performed on a queue of customers who are waiting their turn to be served by a cashier in a bank. The bank needs to improve customer experience by maximising the throughput or minimising the time a customer is in a queue and balance with efficient utilisation of cashiers.

(10 marks)

[Turn Over]