

B11.

A large company has its own IT department that develops software for use internally on a variety of in house projects.

Describe the documentation requirements of **each** of the following groups of people who have been stake holders during the development of a software project which has now been released:

- i. Group 1: End users. **(4 marks)**
- ii. Group 2: IT Administrators/Director of IT services. **(4 marks)**
- iii. Group 3: Software development Team. **(4 marks)**

B12.

- a) Discuss what 'Quality' means in the context of systems development. Your discussion should include examples of quality attributes. **(6 marks)**
- b) Explain the objectives of **TWO** of the following quality assurance procedures carried out during software development:
 - i. Structured walkthroughs;
 - ii. Stress Testing;
 - iii. Peer review.**(6 marks)**

END OF EXAMINATION

BCS THE CHARTERED INSTITUTE FOR IT

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SOFTWARE DEVELOPMENT

Wednesday 4th October 2023 – 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 Section A questions you attempt in Answer Book A
Answer any 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.

You have been asked to write a program to play a simple game. The game will need a set of numbers. The user will enter a loop in which they are repeatedly asked to enter a number and are then informed whether that number is in the set. This will continue until they enter "q" to quit the game.

- a) Write an algorithm in pseudocode to describe how the above problem could be solved. **(5 marks)**
- b) Translate your pseudocode into program code in a language of your choice. **(10 marks)**
- c) Explain how and why programmers use pseudocode during the systems development process. **(5 marks)**
- d) Using a suitable example, describe an alternative to pseudocode that might be used to describe the logic of an algorithm. **(10 marks)**

A2.

'Fizzbuzz' is a maths game intended to help children to learn division. The game is played in teams. The player designated to start the game says the number "1", and the players then count upwards in turn. However, any number divisible by three is replaced by the word "fizz" and any number divisible by five is replaced by the word "buzz". Numbers divisible by both three and five (i.e. divisible by 15) become 'Fizzbuzz'. Players are eliminated if they make a mistake.

- a) Write some code in a language of your choice to play 'Fizzbuzz' by writing the numbers 1 – 100 on the screen with suitable substitutions following the rules of the game as outlined above. **(10 marks)**
- b) Using suitable examples, explain the difference between an IF statement and a SWITCH statement. You should explain when **each** should be used. **(5 marks)**
- c) Using suitable examples, identify **FOUR** types of loop and explain how they are implemented in a programming language of your choice. **(10 marks)**
- d) Explain the role that modules play in the design of structured programs. Give examples of built-in modules available in a programming language of your choice. **(5 marks)**

B9.

The goal for User Interface designers today is to produce user-friendly interfaces that encourage exploration without fear of negative consequences.

Describe in detail **FOUR** design principles that would achieve this goal.

(12 marks)

B10.

- a) Which testing technique (either Black Box or White box) would apply to the following?
 - i. Unit testing;
 - ii. Functional testing.

Justify your answer.

(4 marks)

- b) You have been given the task of testing the pseudocode below (Fig B10), which has been written by another programmer. You have been told the expected output is 16.

Fig B10 Source Code

```
Begin
  A = 3
  B = 5
  While A < 2 * B
    C = A * A
    A = A + 1
    B = B - 1
  EndWhile
  Print C
End
```

- i. Produce a trace table that contains the steps of working through the code. **(6 marks)**
- ii. Does the actual output match the expected output? Justify your answer. **(2 marks)**

[Turn Over]

B6.

Answer the following questions with reference to the code extract given below written in C:

```
void f(char c; float y){int r ; r = 0 ; y =0.0;if(c > '0' && c<= '9' )r +=10 ; y =
sqrt(r;)}printf(r,y);{
```

- a) Rewrite the code so that it is more readable. **(4 marks)**
- b) List **THREE** different data types used. **(3 marks)**
- c) Copy out a statement that contains **each** of the following: **(5 marks)**
- i. A boolean operator;
 - ii. A condition;
 - iii. A declaration;
 - iv. A function call;
 - v. An assignment.

B7.

Describe the Object Oriented (OO) approach to software development using the following headings. Provide examples of some OO source code or pseudocode to illustrate your answer.

- a) Basic concepts (Objects, Classes, Methods, Properties). **(8 marks)**
- b) Inheritance. **(4 marks)**

B8.

- a) Draw a diagram showing the structure of a linked list. **(3 marks)**
- b) Explain, using a diagram and an example, how a new node is INSERTED at the end of a linked list. **(3 marks)**
- c) Write pseudocode for a function called append(linked_list, new_node) that INSERTS a new_node at the end of linked_list. **(6 marks)**

A3.

A Fibonacci sequence of numbers is one in which each number is the sum of the two preceding ones. The following algorithm describes one way of calculating and printing a Fibonacci sequence.

Step 1: Start
 Step 2: Declare variable a, b, c, n, i
 Step 3: Initialize variable a=0, b=1 and i=2
 Step 4: Read n from user
 Step 5: Print a and b
 Step 6: While i<=n:
 Step 6.1: c=a + b
 Step 6.2: print c
 Step 6.3: a=b, b=c
 Step 6.4: i=i+1
 Step 7: Stop

- a) Trace the value of **each** of the variables in this algorithm as it is executed with a value of 5 being assigned to n. **(10 marks)**
- b) Explain how you might make use of debugging tools to find problems in your code. You should describe the debugging tools available in a development environment with which you are familiar. **(10 marks)**
- c) How could this algorithm be restructured to make use of a recursive function? **(10 marks)**

[Turn Over]

A4.

Consider the following piece of code:

```
lower = 900
upper = 1000
print("Target numbers between",lower, "and", upper, "are:")
for num in range(lower, upper+1):
    if num > 1:
        for i in range(2, num):
            if (num % i) == 0:
                break
            else:
                print(num)
```

- a) Explain what the above program is doing and suggest ways in which the code could have been made clearer. You should also discuss more general ways in which programmers can make their programs as readable as possible. **(10 marks)**
- b) Referring to the code above find and write out the following:
- Identifiers;
 - A conditional (logical, boolean) expression;
 - An iterative (repetitive, loop) statement.
- (6 marks)**
- c) What changes would you make to the code in order to replace the FOR loops with WHILE loops? **(5 marks)**
- d) Write a function that will check if a number provided by the user is one of the prime numbers referred to in the above code. **(9 marks)**

Section B

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

B5.

The cosine function $\cos(x)$ can be calculated using a power series as shown in Fig B5:

Fig B5 Cosine function

$$\cos X = \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!}$$

For example the first four terms of the expanded power series are:

$$\cos(x) = 1 - \frac{x^2}{\text{fac}(2)} + \frac{x^4}{\text{fac}(4)} - \frac{x^6}{\text{fac}(6)} + \dots \dots$$

Where:

x is the value in radians to be computed
 $\text{fac}(n)$ represents a built-in function the factorial of n .

For example $\text{fac}(4) = 4 \times 3 \times 2 \times 1 = 24$

Continually computing each successive term improves the accuracy of the calculation. The calculation needs to terminate when a set number of terms has been computed.

- a) Convert the specification given above into a sequence of steps that show how the values of **each** of the first **THREE** terms of the equation are computed given a value of $x=2$. **(3 marks)**
- b) Translate your answer above in part a) into pseudocode (or actual code if you prefer) for any value of x , showing code structures such as sequence, selection and iteration.

You can assume the factorial function ($\text{fac}(n)$) is available and the computation stops after a supplied number of terms.

(9 marks)

[Turn Over]