B5.

a) Compare and contrast how imperative and functional programming languages manipulate data. Include example code to illustrate your answer.

(15 marks)

b) With reference to the following code, discuss how facts, rules and goals are used in a Prolog program.

Explain how this program can be used to find out the possible pairs of grandparent and grandchild.

```
mother(gwen, martha).
mother(martha, anne).
mother(kate, james).

father(adam, martha).
father(peter, james).
father(james, ash).

parent(X,Y) :- mother(X,Y).
parent(X,Y) :- father(X,Y).

grandparent(X,Z) :- parent(X,Y), parent(Y,Z).
```

(10 marks)

END OF EXAMINATION

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 6 Professional Graduate Diploma in IT

PROGRAMMING PARADIGMS

Friday 19th April 2024 - Morning

Answer **any** THREE questions out of FIVE. All questions carry equal marks.

Time: THREE hours

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 Section A questions in Answer Book A

A1.

You have been tasked with creating a traffic census application that will record the number of different types of vehicles that pass a certain point. Typical vehicles will be cars, bicycles, vans, motorbikes and trucks.

a) A challenge for this system is that it will not be known until runtime what type any given passing vehicle would be. This affects the way to store different types in a collection that can be subsequently interrogated to identify the type of each element.

Which **TWO** key features of object-oriented programming would simplify considerably the development of such an application and why? Support your answer with a suitable static model of a potential solution.

(10 marks)

b) Classes are the fundamental building blocks of an object-oriented program. Discuss the importance of designing the class interface and how this facilitates good programming design practice such as a 'separation of concerns'. Support your answer with appropriate examples.

(15 marks)

A2.

Your company is expanding and wants to use a quality driven software development process.

a) Discuss the major advantages and disadvantages of using an Integrated Development Environment (IDE) as a tool to improve quality.

Support your answer with appropriate examples from your knowledge and experience of using an IDE.

(15 marks)

b) Discuss the use of coding standards and standardised languages to improve code quality. Support your answer with appropriate examples using a language that you are familiar with.

(10 marks)

A3.

a) Discuss the use of event-driven programming in software systems. Support your answer with appropriate examples.

(15 marks)

b) Discuss the challenges when debugging event-driven systems.

(10 marks)

Section B
Answer Section B questions in Answer Book B

B4.

The Dining Philosophers problem describes an issue found in concurrent processes. An image showing the problem is shown in Figure 1.

A description of the problem is:

- Five philosophers sit at a round table for dinner (shown as P1 to P5 in the image). They are each served a bowl of spaghetti.
- The spaghetti is slippery, and a hungry philosopher will need 2 forks to be able to eat it, one in each hand. If a philosopher has just one fork, then that philosopher cannot eat.
- Philosophers must think and eat, alternately. When a philosopher is ready to eat, they will try to pick up two of the forks. After eating, a philosopher will put down their forks so that other philosophers can use them.
- There are just five forks on the table.

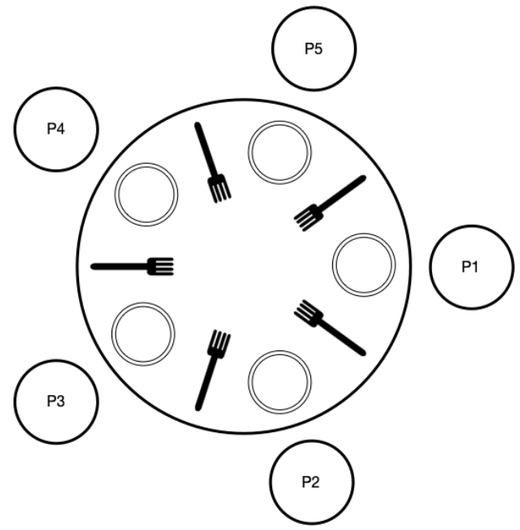

Figure 1: The Dining Philosophers Problem

a) How do the problems of the philosophers correspond to problems in concurrent processes?

(10 marks)

b) Discuss **THREE** methods that are available to help solve the problems that you identified in part a).

(15 marks)

[Turn Over]