

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

SYSTEMS ANALYSIS AND DESIGN

Wednesday 20th April 2022 – Morning

Answer any FOUR questions out of SIX. All questions carry equal marks.

Time: TWO 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.

Case Study for both sections A and B

Wheelies Bicycle Manufacturer

Wheelies is a bicycle manufacturing company based in Holland. Wheelies buy all the parts for its bicycles from various suppliers around the world. The parts are then assembled in the factory in Holland to produce a number of different bicycle models.

Customers of Wheelies place orders for the bicycles they require over the Internet, and delivery is estimated to take three weeks. Each customer order can consist of more than one model of bicycle, and the required quantity of each model is also recorded on the order.

At the end of each week, a forecast is produced so the manufacturing department knows how many of each bicycle model it needs to produce in the following week. The forecast is based on the number of each model in stock and the quantity of each model ordered by customers. The forecast is also used to place purchase orders for parts from the suppliers so that all the necessary parts are available for the week's production.

Each individual bicycle that is assembled has a unique code stamped on the frame. When a customer order is ready for dispatch, the frame code of each actual bicycle allocated to that customer order is recorded so that each bicycle can be traced to a particular customer. The customer order is dispatched together with a corresponding dispatch note by the Sales Department.

B6

- a) Discuss briefly the purpose of sequence diagrams and state machines/charts.
(4 marks)

- c) Produce a sequence diagram for the use case 'Place purchase order' in the Wheelies system described above. A brief description of this use case is given below.

"A list of all current suppliers is displayed by the system. A manager selects the required supplier from the list and the system displays the selected supplier's details and a list of parts provided by this supplier. Next the manager creates the purchase order by selecting the relevant parts from the list of parts. The manager also enters the required quantity for each part".

(13 marks)

- d) Produce a state machine/chart for the class Customer Order in the Wheelies system.

You may assume that the objects of this class are affected by the following 'events' (listed below in alphabetical order):

Amend an order
Cancel an order
Despatch an order
Fulfil an order
Place an order

(8 marks)

End of Examination

Section A
Answer Section A questions in Answer Book A

A1

- a) Discuss the main elements and properties of data flow diagrams (DFDs).
(10 marks)

- b) Explain the main differences between logical and physical DFDs.
(5 marks)

- c) Produce a Level 0 (i.e. Context) data flow diagram of the Wheelies company. State all the necessary assumptions you made.
(10 marks)

A2

- a) Explain the concept of use cases and discuss the main elements and properties of use case diagrams.
(8 marks)

- b) Produce a use case diagram for the Wheelies system.
(9 marks)

- c) Produce a use case description for the Wheelies' use case "Place a customer order".

The use case description should clearly specify (in the right order) actor's actions and system's actions/responses. You may assume that Wheelies invoice and collect payments after delivery of the order.

(8 marks)

A3

- a) Explain the purpose of a Feasibility Report and when in the systems development life cycle it should be produced.

Give a brief overview of the following sections of a typical Feasibility Report: Organisational/Social impact, Technical options, Cost/benefit analysis.

(11 marks)

- b) What is a requirements document and who is normally responsible for its production?

When in the systems development life cycle should a requirements document be produced?

(7 marks)

- c) Explain the difference between functional and non-functional requirements.

Give examples of **TWO** functional and **TWO** non-functional requirements based on the Wheelies system.

(7 marks)

[Turn Over]

Section B
Answer Section B questions in Answer Book B

B4

This question refers to the case study described on page 2 (i.e. Wheelies Bicycle Manufacturer). The table below shows an example of a list of customer orders:

Order No:	Order date:	Customer No:	Customer tel. no:	Customer address:
	Model code:	Model name:	Quantity:	
	Model code:	Model name:	Quantity:	

Order No:	Order date:	Customer No:	Customer tel. no:	Customer address:
	Model code:	Model name:	Quantity:	

Order No:	Order date:	Customer No:	Customer tel. no:	Customer address:
	Model code:	Model name:	Quantity:	

- a) Normalise the table to produce a set of relations in the Third Normal Form. You must show all of your working, explaining each step.
(18 marks)
- b) Draw an entity relationship diagram (ERD) based on the relations produced in part a).
(7 marks)

B5

- a) Provide a brief explanation of the following concepts in object orientation:
- i) Class and object
 - ii) Encapsulation
 - iii) Message passing.

(7 marks)

- b) Consider the following extra information about the Wheelies Bicycle Manufacturer described previously:

“There are two types of customers: individual customers and business customers, e.g. shops. The following data are stored about each customer: Customer No, Customer tel. no; Customer email address, Customer address.

In addition, individual customers have the following attribute: Customer name, and business customers have the following attributes: Business name, Manager name.

Each bicycle model consists of a frame, 2 wheels, a handlebar, a seat.”

Explain the following relationships between classes using examples from the Wheelies system to illustrate your answers:

- i) Association
- ii) Aggregation or composition
- iii) Generalisation/inheritance.

The examples should show relevant fragments of a class diagram.

Explain also, the differences between generalisation/inheritance and aggregation relationships between classes.

(18 marks)