BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

SYSTEMS ANALYSIS & DESIGN

Monday 4th October 2021 – Morning

Time: TWO hours

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

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.

Case Study for Sections A and B

Tools-4-U

Tools-4-U is a tool hire company. The company has a number of branches and offers tools for hire to both the general public and the building trade. The tools available for hire range from screwdriver sets and do-it- yourself power tools, to plant machinery such as mechanical diggers.

The tools can be hired for a day or for up to a period of 3 months, although each category of tool has a maximum hire period. For example, electric hand drills are categorised as DIY power tools, with a maximum hire period of one week. Mechanical diggers and bulldozers are categorised as plant machinery and can be hired for up to 3 months. Some categories of tool can only be hired by members of the building trade because special training is required to use them.

When a customer wishes to hire a tool, they can either come to one of the branches in person and take the tool immediately (if it is available), or they can reserve a tool online in advance of the requested hire period. Usually, customers reserve large tools to make sure they are available when needed, but Tools-4-U also carries a large number of the smaller tools, which are usually available without a reservation. When a customer collects a tool, they must provide their name and address, company details if they are a trade customer, and the period of time the tool will be hired for. All these hire details are recorded by Tools-4-U staff.

Private customers must pay the full cost of the hire at the start of the hire period, as well as a refundable deposit. Trade customers only pay the deposit at the start of a hire period, but will receive an invoice at the end of the month. When a customer returns the hired tool or tools, they receive back the whole deposit if the tool is in good condition. If it is not, a reduced deposit is paid back. From time to time, a manager of a branch adds new tools to the branch's inventory and removes old ones.

A1.

a) Produce a top level (Level 1) data flow diagram (DFD) for the Tools-4-U system.

(15 marks)

b) Compare the use of a data flow diagram with an activity diagram for modelling business processes.

Your comparison should include an explanation of both notations. There is no need to model the above scenario again.

(10 marks)

A2.

a) Explain the meaning of use cases.

(5 marks)

b) Draw a use case diagram for the Tools-4-U system.

(12 marks)

c) Produce a use case description for **ONE** of the use cases in your diagram (except invoicing trade customers). The use case description should clearly specify (in the right order) actor's actions and system's actions/responses.

(8 marks)

A3.

a) Consider the following requirements elicitation/gathering techniques:

i) Interviews;
ii) Questionnaires.

Explain **each** of these techniques and discuss the advantages and disadvantages of **each**.

(16 marks)

b) Explain throw away prototyping and why throw away prototyping can be used as a 'requirements gathering tool' in more traditional approaches to systems development.

(9 marks)

B4.

This question refers to the case study described on page 2 (i.e. Tools-4-U). The table below shows an example of a list of customers and details of their tool hires.

Customer No.:	Customer name:	Cust address:			
	Hire code:	Hire date:	Hire length:		
		Tool category:	Tool code:	Tool make:	Tool model:
		Tool category:	Tool code:	Tool make:	Tool model:
		…..	…..	…..	
	Hire code:	Hire date:	Hire length:		
		Tool category:	Tool code:	Tool make:	Tool model:
		…..	…..	….	…..
	…..	…..	…..		
Customer No:	Customer name:	Cust address:			
	Hire code:	Hire date:	Hire length:		
		Tool category:	Tool code:	Tool make:	Tool model:
		…..	…..	…..	…..
Customer No:	Customer name:	Cust address:			
	Hire code:	Hire date:	Hire length:		
		Tool category:	Tool code:	Tool make:	Tool model:
		…….	……..	……..	…….

a) Normalise the table to produce a set of relations in the Third Normal Form. You must show all of your workings and explain each step.

(18 marks)

b) Explain briefly how you would map an inheritance hierarchy in a class diagram to relational database tables. Consider **TWO** possible approaches.

(7 marks)

B5.

a) Explain the following relationships between classes, using examples from the Tools-4-U system to illustrate your answers:

      i)   Association;
      ii)   Generalisation/inheritance.

The examples should show relevant fragments of a class diagram.

(10 marks)

b) Discuss briefly the main similarities and differences between sequence and communication diagrams.

(5 marks)

c) Draw a sequence diagram for the use case "Customer enquiry" in the Tools-4-U system. A brief description of this use case is given below:

"A list of all customers is displayed by the system. A manager selects one customer and the system displays the customer's details followed by a list of all hires made by this customer. This list includes details of all relevant hires and corresponding tools hired by the customer".

(10 marks)

B6.

a) What is a state machine/statechart? In your answer, you should explain the meaning, purpose and the main elements of state machines/statecharts.

(9 marks)

b) Explain how you would check consistency between:

      i)   State machines/statecharts and Class diagrams;
      ii) State machines/statecharts and Sequence diagrams.

(8 marks)

c) Produce a state machine/statechart for the class Reservation in the Tools-4-U system. You may assume that the objects of this class are affected by the following 'events':

      i)   Amend reservation;
      ii) Cancel reservation;
      iii) Hire reserved tool(s);
      iv) Reserve tool(s).

(8 marks)

End of Examination