BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

SYSTEMS ANALYSIS & DESIGN

Tuesday 4th May 2021 - 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

BCSCabs is an independent taxi company operating in a major city. BCSCabs owns taxis which it rents out to drivers on an annual basis. Each vehicle is effectively rented out to three drivers to cover three 8 hour shifts in a day. BCSCabs is a profitable company because it has built up a good reputation locally, and there is always a waiting list of drivers wanting to apply to rent a vehicle. BCSCabs expands gradually by purchasing new vehicles from local car dealers.

Each driver pays an annual rental fee in advance to BCSCabs in return for use of a vehicle for 8 hours a day every day of the year. In addition to the annual rental, BCSCabs takes 5% of the money a driver earns every week. BCSCabs is responsible for taxing, insuring and maintaining the vehicles. If a vehicle is due for a service or needs to be repaired, BCSCabs contacts a garage and arranges it. BCSCabs keeps records of the repairs and services for each vehicle, and records of the corresponding garages.

At the end of each shift, drivers give the money they have earned to BCSCabs. If they needed to refuel the vehicle, they also submit an expense claim at the end of the shift. At the end of every week, BCSCabs calculates the amount owed to each driver based on the money earned from fares, the expense claims and the deduction of 5%. The drivers are then paid.

Section A
Answer Section A questions in Answer Book A

A1.

a) Develop a context diagram for BCSCabs.

(5 Marks)

b) Develop a level one Data Flow Diagram consistent with your context diagram.

(10 Marks)

c) Compare the technique of data flow modelling with business activity modelling. There is no need to model the BCSCabs company scenario again, but you **SHOULD** describe the notation of the business activity model as part of your comparison.

(10 Marks)

A2.

a) With reference to the BCSCabs case study, produce a system Use Case Description for the normal scenario of the Use Case 'Calculate the amount owed to pay driver' which can be used at the end of each week to assist payroll.

(10 Marks)

b) With reference to your Use Case Description, illustrate what an alternative scenario is and how they are handled in use case realisation.

(7 Marks)

c) Explain how you might use a prototyping approach to develop a user interface that supports the Use Case we have been discussing.

(8 Marks)

A3.

a) What is meant by the term "evolutionary prototyping" as used in software development?

(7 Marks)

b) What tools could you use when following an evolutionary prototyping approach?

(8 Marks)

c) Describe the differences between high fidelity prototyping and low fidelity prototyping and give an example for each, illustrating how you would use it with reference to BCSCabs.

(10 Marks)

[Turn Over]

Section B
Answer Section B questions in Answer Book B

B4.
The table below shows an example of an annual report produced for all garages used by the BCSCabs company described in the case study. The table shows the maintenance services done on each vehicle as well as details of the vehicles e.g. Make, Date of registration , Car dealer's name, etc.

Garage name:	**Garage tel no:**			
Vehicle no:	**Make:**	**Date of registration:**	**Dealer's name:**	**Dealer's tel no:**
	Service date:	**Description:**		
	Service date:	**Description:**		
	…	**…**		
Vehicle no:	**Make:**	**Date of registration:**	**Dealer's name:**	**Dealer's tel no:**
	Service date:	**Description:**		
	Service date:	**Description:**		
	…	**…**		
Vehicle no:	**Make:**	**Date of registration:**	**Dealer's name:**	**Dealer's tel no:**
	Service date:	**Description:**		
	…	**…**		
Garage name:	**Garage tel no:**			
Vehicle no:	**Make:**	**Date of registration:**	**Dealer's name:**	**Dealer's tel no:**
	Service date:	**Description:**		
…	**…**			

a) Normalise the table to produce a set of relations in the Third Normal Form. You **MUST** show all your workings, explaining each step.

(18 marks)

b) Draw an Entity Relationship Diagram (ERD) based on the relations produced in part a).

(7 marks)

B5.

a) Consider the following extra information about the BCSCabs company described in the case study:

"In addition to conventional taxis, BCSCabs plans to introduce small minibuses. The following data will be stored about each vehicle: *Vehicle no., Make, Date of registration, Mileage*. For conventional taxis *Taximeter no.* is also stored. For minibuses *No. of seats* is also stored".

"An object of class Vehicle consists of a chassis and an engine."

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

i) Association;
ii) Aggregation or Composition;
iii) Generalisation/Inheritance.

(15 marks)

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

(10 marks)

B6.

a) Give a brief explanation of the following UML diagrams:

i) Sequence diagram;
ii) State machine/statechart.

(4 marks)

b) Draw a state machine/statechart for the class service in the BCSCabs system described in the case study. You may assume that objects of this class are affected by the following 'events' (listed in alphabetical order): Book service, Cancel service booking, Delete service, Finish service, Start service.

You can assume that service records are deleted 12 months after the corresponding services were finished.

(9 marks)

c) Produce a sequence diagram for the Use Case 'Allocate driver to vehicle' in the BCSCabs system described in the case study. A brief description of this use case is given below:

"The vehicle number is entered by a manager. The system displays the vehicle's details and next the system displays a list of all unallocated drivers. The manager selects one driver from the list. The system then 'links' the selected driver with the vehicle".

(12 marks)

End of Examination