

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

**SYSTEMS ANALYSIS & DESIGN**

Monday 28<sup>th</sup> September 2015 - 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 <b>NOT</b> allowed in this examination.
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**Case Study for both sections A and B**

**Q-Taxi**

Q-Taxi is a small independent taxi company operating in a major city. Q-Taxi owns 25 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: therefore there are 75 taxi drivers contracted to Q-Taxi at any given time. Q-Taxi 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.

Each driver pays an annual rental fee in advance to Q-Taxi giving them use of a vehicle for 8 hours a day every day of the year. In addition to the annual rental, Q-Taxi takes 5% of the money a driver earns every week. Q-Taxi is responsible for taxing, insuring and maintaining the vehicles. If a vehicle is due for a service or needs to be repaired Q-Taxi contacts a garage and arranges it. Q-Taxi keeps an account of the repair and service costs for each vehicle.

At the end of each shift drivers give the money they have earned to Q-Taxi. 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 Q-Taxi calculates the amount owing to each driver based on the money earned from fares, the expense claims and the deduction of 5%. The drivers are then paid.

**[Turn over]**

## Section A

### Answer Section A questions in Answer Book A

A1

- a) Produce an activity diagram with swim lanes to represent the business activities and processes of Q-Taxi (you do not need include activities that only happen once a year).  
**(11 marks)**
- b) List the processes and the external entities that you would include on a LOGICAL top level data flow diagram (DFD) of Q-Taxi. (You do not need to draw the DFD).  
**(7 marks)**
- c) Explain the differences between a logical DFD and an activity diagram. Use your answers to parts (a) and (b) to illustrate your points. (You should not compare the notation).  
**(7 marks)**

A2

- a) Explain what a prototype is and describe how it can be used in requirements gathering.  
**(8 marks)**
- b) What are the advantages and disadvantages of prototyping?  
**(10 marks)**
- c) Briefly describe how prototypes can be used in other stages of the system development life cycle.  
**(7 marks)**

A3

- a) What is a CASE tool and what features would you expect a CASE tool to have?  
**(11 marks)**
- b) Describe how a CASE tool can help to improve the quality of a system being developed.  
**(14 marks)**

## Section B

### Answer Section B questions in Answer Book B

B4

The table below shows an example of an annual report produced for all vehicles/taxis in the Q-Taxi company described in the case study showing the maintenance services done on each vehicle.

<b>Vehicle No:</b> T501ABC	<b>Make:</b> Ford	<b>Date of registration:</b> 4/10/2009	
	<b>Driver:</b> J Smith	<b>Driver's tel. no:</b> 6031240	
	<b>Driver:</b> A Brown	<b>Driver's tel.no:</b> 5084222	
	<b>Driver:</b> J Patel	<b>Driver's tel.no:</b> 6012345	
<b>Service date:</b> 3/2/2014	<b>Description:</b> Regular service	<b>Garage name:</b> ZCars	<b>Garage address:</b> 1 Main Street, London
<b>Service date:</b> 12/8/2014	<b>Description:</b> Regular service	<b>Garage name:</b> Apollo cars	<b>Garage address:</b> 3 Commercial Rd, London
<b>Service date:</b> 23/11/2014	<b>Description:</b> Additional service	<b>Garage name:</b> ZCars	<b>Garage address:</b> 1 Main Street, London
.....	.....	.....	.....
<b>Vehicle No:</b> X887TWV	<b>Make:</b> Opel	<b>Date of registration:</b> 15/9/2010	
	<b>Driver:</b> B Jones	<b>Driver's tel.no:</b> 6221207	
	.....	.....	.....

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

**[Turn over]**

B5

- a) Consider the following extra information about the Q-taxi company described in the case study:

“In addition to drivers who rent taxis Q-Taxi plans to employ car owners who will be using their own cars, for example chauffeur driven limousines. The following data will be stored about each driver: *Driver name, Tel. number, Address*. For drivers who rent taxis *Annual rental fee* is also stored. For drivers who own their cars *Car registration number* is stored.”

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

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

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

**(15 marks)**

- b) There are many characteristics/attributes of a good software design. List FIVE of them and provide a brief explanation of each.

**(10 marks)**

B6

- a) Discuss briefly the similarities and differences between the following UML diagrams:

- Sequence diagram
- Communication/collaboration diagram.

**(6 marks)**

- b) Give a brief explanation of the role that sequence diagrams play in systems modelling with the emphasis on designing the interaction between the user and the system.

**(6 marks)**

- c) Produce a sequence diagram for the use case ‘Arrange a vehicle repair’ in the Q-Taxi system described in the case study. A brief description of this use case is given below.

“The details of a vehicle to be repaired are entered by a manager. The system responds by displaying a list of all drivers who are allocated to this vehicle. The manager also enters a brief description of the fault and the details of a garage. The system then creates a corresponding fault repair record”.

**(13 marks)**