

**BCS THE CHARTERED INSTITUTE FOR IT**

**BCS HIGHER EDUCATION QUALIFICATIONS**  
**BCS Level 5 Diploma in IT**

**SYSTEMS ANALYSIS AND DESIGN**

Wednesday 27<sup>th</sup> April 2011 - Afternoon

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

**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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**Section A**

Answer Section A in Answer Book A

A1. 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.

- a) Taking the Q-Taxi office as the scope of the system under investigation produce a top level data flow diagram.

**(15 marks)**

- b) Compare the notation of a dataflow model with that of a use case model, and explain what each element of the notation represents.

**(10 marks)**

**Turn over]**

A2. a) List SEVEN techniques for eliciting requirements. (7 marks)

b) Explain TWO of these techniques in detail including the advantages and disadvantages of each technique. (18 marks)

A3. a) When in the system development life cycle would you produce a business case, and why? (4 marks)

b) Describe the contents of a business case. (21 marks)

### Section B

Answer Section B 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 Question A1 showing the maintenance services done on each vehicle.

<b>Vehicle No:</b> T501ABC	<b>Make:</b> Ford	<b>Date of registration:</b> 4/10/2006	
	<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> 3/2/2008	<b>Description:</b> Regular service	<b>Garage name:</b> ZCars	<b>Garage address:</b> 1 Main Street, London
<b>Service date:</b> 12/8/2008	<b>Description:</b> Regular service	<b>Garage name:</b> Apollo cars	<b>Garage address:</b> 3 Commercial Rd, London
<b>Service date:</b> 23/11/2008	<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> 15/9/2007	
	<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) Draw an entity relationship diagram (ERD) based on the relations produced in part (a). (7 marks)

B5. Consider the following extra information about the Q-taxi company described in Question A1:

“Q-Taxi plans to expand to rent out minibuses as well. The following data must be stored about each vehicle (both taxis and minibuses): *Registration number*, *Make*, *Date of registration*. For taxis *Taximeter code* also must be stored, while for minibuses *Max number of passengers* should be stored.”

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

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

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

**(15 marks)**

b) Discuss at least TWO similarities and TWO differences between Class diagrams and Entity Relationship diagrams (ERDs).

**(10 marks)**

B6. a) Explain how the following UML diagrams relate to one another.

- i) Class diagrams,
- ii) Sequence diagrams,
- iii) State machines/statecharts.

**(7 marks)**

b) i) Give a brief explanation of the role state machines/statecharts play in systems modeling.

**(4 marks)**

- ii) Produce a state machine/statechart for the class Vehicle in the Q-Taxi system described in Question A1. You may assume that objects of this class are affected by the following ‘events’: *registration of a new vehicle*, *de-registration of a vehicle*, *start of vehicle rental*, *end of vehicle rental*, *start of vehicle repair/servicing*, *end of vehicle repair/servicing*.

**(14 marks)**