

**BCS THE CHARTERED INSTITUTE FOR IT**

BCS HIGHER EDUCATION QUALIFICATIONS  
BCS Level 5 Diploma in IT

**SYSTEMS ANALYSIS AND DESIGN**

Monday 2<sup>nd</sup> October 2023 - Morning

Time: TWO hours

Answer **any** 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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## **Case Study for both sections A and B**

### **Western coaches**

Western Coaches is a coach company based near Bristol. They specialise in organising day trips to various destinations in England. Customers of Western Coaches include institutions such as schools, nursing homes etc. They hire coaches with drivers for trips which are organised/arranged especially for them.

Customers will typically make an online request that a day trip be organised for them on a specific date. In response to this request Western Coaches will check to see if a coach can be made available on that date. If a coach is available Western Coaches will allocate a driver and create a Booking for the customer. Customers are allowed to cancel a Booking before a deposit is paid. The deposit should be paid online within 7 days of the booking being taken. If a booking is cancelled after that, the deposit is kept by Western Coaches. If a trip is cancelled, the Booking record is updated.

Western Coaches will request full online payment for a Booking in the week before it takes place.

A cancelled trip is deleted from the system 6 months after cancellation. Other trip records are deleted 12 months after the corresponding trips were completed.

**B6.**

a) Provide a brief explanation of the following concepts in object-orientation:

- i. Encapsulation;
- ii. message passing;
- iii. inheritance;
- iv. polymorphism.

**(8 marks)**

b) UML statecharts/state machines and activity diagrams are based on a similar notation. They have however completely different meanings. Discuss the main differences between these diagrams.

**(5 marks)**

c) Produce a state machine/chart for the class Trip in the Western Coaches system described above.

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

- Arrange a trip;
- Cancel a trip;
- Complete a trip;
- Delete a trip;
- Deposit paid;
- Final payment paid.

**(12 marks)**

**END OF EXAMINATION**

**Section A**  
**Answer Section A questions in Answer Book A**

**A1.**

a) Using information from the case study on page 2, produce a logical top level data flow diagram for a Booking System for Western Coaches.

**(12 marks)**

b) Using information from the case study on page 2, create a Use Case diagram for Western Coaches.

**(7 marks)**

c) Briefly explain the difference between a high-level DFD and a Use Case diagram.

**(6 marks)**

**A2.**

a) The following are four phases in the Systems Development Life Cycle (SDLC).

For **each** phase identify **TWO** deliverables, briefly describe each of these deliverables and identify the techniques used to produce it.

- i. Requirements Identification;
- ii. Analysis;
- iii. Design;
- iv. Implementation.

**(20 marks)**

b) Briefly describe the waterfall method to systems development and briefly explain why this method is less popular now than it used to be.

**(5 marks)**

**A3.**

a) What is the difference between systems prototyping and throwaway prototyping methodologies?

**(10 marks)**

b) Identify **THREE** different roles the user might play in a development project and comment on any problems that might arise with each of these.

**(15 marks)**

**[Turn Over]**

**Section B**  
**Answer Section B questions in Answer Book B**

**B4.**

The table below shows an example from Western coaches of a list of coaches, trips to which the coaches are allocated, and the corresponding drivers.

<b>Coach No.:</b> DV16PPS	No of seats: 50				
	Trip No: 11/23	Trip date: 6/5/23	Trip destination: Bath	Driver Name: Smith J	Driver TelNo: 07923668102
	Trip No: 35/23	Trip date: 4/6/23	Trip destination: Devon	Driver Name: Brown V	Driver TelNo: 07976222333
		.....	.....		
<b>Coach No.:</b> RS15VVX	No of seats: 56				
	Trip No: 28/23	Trip date: 18/5/23	Trip destination: Oxford	Driver Name: Smith J	Driver TelNo: 07923668102
		.....	.....		
<b>Coach No.:</b> TD16BBD	No of seats: 62				
	Trip No: 09/23	Trip date: 2/3/23	Trip destination: Windsor	Driver Name: Ramsey D	Driver TelNo: 07710555777
	Trip No.: 36/23	Trip date: 5/6/23	Trip destination: Cardiff	Driver Name: Wilson P	Driver TelNo: 07740222244
		.....	.....		

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.**

Consider the following extra information about the Western Coaches system:

“There are two types of coach drivers: full-time drivers and part-time drivers. The following data should be stored about each full-time driver: Driver name, Date of birth, Contact details, Salary. The attributes of each part time driver are: Driver name, Date of birth, Contact details, Hourly rate, Hours worked.

All drivers are required to submit their CVs. A CV consists of a header, a number of CV lines, a driver’s signature.”

- a) Explain the following relationships between classes using examples from the Golden Racquet system to illustrate your answers:
- i. Association;
  - ii. Aggregation or Composition;
  - iii. Generalisation/Inheritance.

The examples should show relevant fragments of a class diagram.

**(15 marks)**

- b)
- i. Briefly discuss the purpose of sequence diagrams.
  - ii. Produce a sequence diagram for the use case ‘Allocate coaches to trip’ in the Western Coaches system. A brief description of this use case is given below.

“A manager enters the trip number, and the system displays the trip details. Next the system displays a list of all available coaches. The manager selects one (or more) coach(es), and the system allocates this (these) coaches to the trip and displays the confirmation message.”

**(10 marks)**

**[Turn Over]**