

# **BCS THE CHARTERED INSTITUTE FOR IT**

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

### **SYSTEMS ANALYSIS & DESIGN**

Monday 23<sup>rd</sup> September 2013 - 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.

Only <b>non-programmable</b> calculators are allowed in this examination.
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#### **Case Study for both sections A and B**

##### **Local Health Centre**

More than 2000 patients are registered with a local health centre. The centre employs a number of general practitioners (i.e. doctors) and a few receptionists. Patients are officially registered with one doctor but can arrange appointments with any available one. These appointments may subsequently be cancelled. Some appointments result in one or more prescriptions, identifying a medicine to be taken.

New patients are registered by a receptionist. When a patient is registered he/she provides his/her details such as name, date of birth, address, etc., and receives a unique patient number.

To book an appointment a patient should contact a receptionist. The patient provides his/her number (or date of birth) and the receptionist provides a list of available time slots for appointments. The appointment is booked with the patient's doctor or if the patient's doctor is not available with any available doctor. The date and time of the booked appointment are given to the patient as a confirmation.

Patients can cancel booked appointments by contacting a receptionist who will cancel appointments on behalf of patients.

A patient who attends an appointment should check in first using a special terminal located in the waiting area of the health centre. The patient inputs his/her number (or date of birth). The system checks the details and confirms that the patient has been checked in.

Doctors record appointment outcomes and details of prescriptions (if any) during the appointments i.e. all prescriptions issued by doctors are recorded on the patient's record.

Patients who leave the area where the health centre is located are de-registered by a receptionist.

**Turn Over]**

## Section A

### Answer Section A questions in Answer Book A

A1

- a) Produce a context diagram of the health centre system described above. (6 marks)
- b) Produce a **logical** top level data flow diagram of the health centre system. (19 marks)

A2

- a) Explain the difference between a waterfall and an iterative/incremental System Development Life Cycle. Illustrate your answer with diagrams. (15 marks)
- b) Which approach would you recommend for developing the system for a health centre similar to the one described in the case study above? Justify your recommendation. (10 marks)

A3

- a) A company has decided to purchase 'off the shelf' (OTS) software to handle the financial aspects of its business. List at least 10 criteria that should be used to decide whether various software applications are suitable for the company.  
(Hint – You do not need to list detailed functional/non-functional requirements). (19 marks)
- b) If no OTS software can be found that exactly matches the required criteria, what other options does the company have to obtain suitable software? (6 marks)

## Section B

### Answer Section B questions in Answer Book B

B4

- a) This question refers to the case study described above relating to a local health centre. The table below shows an example of a list of appointments arranged with doctors.

<b>Doctor no.: 1</b>	<b>Doctor name:</b> Smith J	<b>Doctor room no.:</b> G5			
		<b>Appointment date:</b> 2/9/12	<b>Appointment time:</b> 10.20	<b>Patient No.:</b> 217	<b>Patient name:</b> Jones J
		<b>Appointment date:</b> 3/9/12	<b>Appointment time:</b> 9.40	<b>Patient No.:</b> 357	<b>Patient name:</b> Patel J
		.....	.....	....	.....
<b>Doctor no.: 3</b>	<b>Doctor name:</b> Mills D	<b>Doctor room no.:</b> G2			
		<b>Appointment date:</b> 3/9/12	<b>Appointment time:</b> 13.40	<b>Patient No.:</b> 87	<b>Patient name:</b> Brown G
		.....	....	....	
<b>Doctor no.:4</b>	<b>Doctor name:</b> Fitzgerald J	<b>Doctor room no.:</b> G3			
		<b>Appointment date:</b> 2/9/12	<b>Appointment time:</b> 11.20	<b>Patient No.:</b> 412	<b>Patient name:</b> Wilson P
		.....	.....	....	.....
		.....	.....	.....	.....

Normalise the table to produce a set of relations in the third normal form. You must show all of your working explaining each step.

**(14 marks)**

- b) Draw an entity relationship diagram (ERD) based on the relations produced in part a).

**(6 marks)**

- c) Give a brief explanation of denormalisation in data base design.

**(5 marks)**

**Turn Over]**

B5

- a) Consider the following extra information about the local health centre system described above:

“There are two types of doctors: full time doctors and visiting doctors. The following data should be stored for both types of doctors: *Doctor no.*, *Doctor name*, *Doctor tel. no.*, *Doctor room no.* For visiting doctors additional attributes are: *Next visit date*, *Next visit duration*. An object of class Prescription consists of a Header, a number of prescription lines, a doctor’s signature.”

Explain the following relationships between classes using examples from the local health centre system to illustrate your answers:

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

The examples should show relevant fragments of a class diagram.

**(15 marks)**

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

**(10 marks)**

B6

- a) Give a brief explanation of object interaction and collaboration in object-oriented systems. Discuss the similarities and differences between sequence and communication/collaboration diagrams.

**(6 marks)**

- b) Produce a sequence diagram for the use case ‘Check in’ in the local health centre system described above. A brief description of this use case is given below.

“The patient enters his/her date of birth. The system searches patient and appointment details. The name, appointment details (date, time), and the doctor’s details (name, room no.) are displayed for patients with a matching date of birth and an appointment on that day.”

**(13 marks)**

- c) Provide a brief explanation of the following characteristics/attributes of a good software design: Efficiency, Flexibility, Reusability.

**(6 marks)**