

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

**SYSTEMS ANALYSIS & DESIGN**

**Monday 20<sup>th</sup> March 2017 - 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**

**Medical Appointments System**

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.

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 receptionists.

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

A1.

- a) Produce a context diagram of the Medical Appointments System described above.  
**(6 marks)**
- b) Produce a logical top level data flow diagram of the Medical Appointments System.  
**(19 marks)**

A2.

- a) Explain the difference between a waterfall and an iterative/incremental System Development Life Cycle (SDLC). Illustrate your answer with diagrams.  
**(15 marks)**
- b) Which approach would you recommend for developing a system for medical appointments 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. Describe at least 10 general criteria that should be used to decide which OTS software applications are suitable for the company.  
**(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. This question refers to the case study described above – the Medical Appointments System. The table below shows an example of a list of appointments arranged with doctors.

<b>Doctor no.: 1</b>	Doctor name: Smith J	Doctor room no.: G5			
	Appointment code: 2016/702	Appointment date: 2/9/16	Appointment time: 10.20	Patient No.: 217	Patient name: Jones J
	Appointment code: 2016/717	Appointment date: 3/9/16	Appointment time: 9.40	Patient No.: 357	Patient name: Patel J
		.....	.....	....	.....
<b>Doctor no.: 3</b>	Doctor name: Mills D	Doctor room no.: G2			
	Appointment code: 2016/726	Appointment date: 3/9/16	Appointment time: 13.40	Patient No.: 87	Patient name: Brown G
		.....	....	....	
<b>Doctor no.:4</b>	Doctor name: Fitzgerald J	Doctor room no.: G3			
	Appointment code: 2016/705	Appointment date: 2/9/16	Appointment time: 11.20	Patient No.: 412	Patient name: Wilson P
		.....	.....	....	.....
		.....	.....	.....	.....

- 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. **(16 marks)**
- b) Draw an Entity Relationship Diagram (ERD) based on the relations produced in part (a). **(9 marks)**

B5.

- a) Consider the following extra information about the Medical Appointments System described above:

“There are two types of patients: fully registered patients and visiting patients. The following data should be stored about each fully registered patient: *Patient no.*, *Patient name*, *Patient address*, *Patient date of birth*, *Patient tel no.*, The attributes of each visiting patient are: *Patient name*, *Patient address*, *Patient date of birth*, *Patient doctor details*.”

An object of class Prescription consists of a Header, a number prescription lines, a doctor’s signature”

Explain the following relationships between classes using examples from the Medical Appointments 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 Medical Appointments System described above. A brief description of this use case is given below.

*"The patient enters his/her date of birth. The system searches the patient's and appointment's details and displays the patient's name, the appointment details (date, time) and the doctor's details (name, room no.)"*.

**(10 marks)**

- c) Produce a state machine/chart for the class Appointment in the Medical Appointments System described above. You may assume that objects of this class are affected by the following 'events' (listed below in alphabetical order):

- Archive an appointment – to remove an appointment from the system
- Arrange an appointment -to create a new appointment
- Check in for an appointment
- Complete an appointment – for a doctor to record any information about completed appointment

**(9 marks)**