

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

SYSTEMS ANALYSIS & DESIGN

Monday 3rd October 2022 – 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 **NOT** allowed in this examination.

Case Study for both sections A and B

Local health centre

More than 3000 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, they provide their details such as name, date of birth, address, etc. and receive a unique patient number.

To book an appointment, a patient should contact a receptionist. The patient provides their 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 either by contacting a receptionist who will cancel appointments on their behalf, or they can do it directly by using the Health Centre's website.

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 their unique patient 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.

B6.

- a) Produce a sequence diagram for the use case 'Display patient's current appointments' in the local health centre system described above.

A brief description of this use case is given below:

"The patient's number or date of birth is entered by a receptionist. The system displays the patient's details followed by details of his/her current appointments (date, time)".

(10 marks)

- b) Give a brief explanation of state machines/state charts. **(4 marks)**
- c) Produce a state machine/chart for the class Appointment in the local health centre 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.
 - Book an appointment - to create a new appointment.
 - Cancel an appointment.
 - Check in for an appointment.
 - Complete an appointment – for a doctor to record any information about completed appointment.
- (11 marks)**

End of Examination

Section A
Answer Section A questions in Answer Book A

A1.

- a) Produce a logical top level data flow diagram of the local health centre system. **(10 marks)**
- b) Produce a use case diagram for the local health centre system. For one of the use cases, identify steps in the primary path that would be developed during use case elaboration. **(10 marks)**
- c) Explain the different roles that data flow diagrams and use case diagrams play in systems development. **(5 marks)**

A2.

- a) Explain the main differences between a structured and an object-oriented approach to systems analysis. **(10 marks)**
- b) Explain the steps you would take in developing a medical appointments system similar to the one described in the case study above. Identify the deliverables associated with each step. **(15 marks)**

A3.

- a) Explain the contribution that each of the following would make to the systems development process:
- i) Business analysts
 - ii) Systems analysts
 - iii) Systems architects.
- (18 marks)**
- b) Explain the role of stakeholder analysis in systems development. **(7 marks)**

[Turn Over]

Section B
Answer Section B questions in Answer Book B

B4.

- a) This question relates to the case study described on page 2: the local health centre system.

The table below shows an example of a list of patients and their appointments arranged with doctors.

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

Patient Number .: 1	Patient name: Smith J	Date of birth: 27/09/1956	Doctor name: Fitzgerald P		
		Appointment date: 22/8/21	Appointment time: 10.30	Doctor name: Ward J	Doctor room number: G4
		Appointment date: 3/4/22	Appointment time: 9.40	Doctor name: Ward J	Doctor room number: G4
		Appointment date: 10/5/22	Appointment time: 13.30	Doctor name: Fitzgerald P	Doctor room number: G2

Patient Number.: 3	Patient name: Mills D	Date of birth: 12/05/1989	Doctor name: Ward J		
		Appointment date: 3/9/20	Appointment time: 13.40	Doctor name.: Fitzgerald P	Doctor room number: G2
	
	
Patient Number.:4	Patient name: Brown P	Date of birth.: 15/7/2000	Doctor name: Ward J		
		Appointment date: 2/08/20	Appointment time: 11.20	Doctor name: Bayer C	Doctor room number: G7
		Appointment date: 2/10/20	Appointment time: 12.00	Doctor name: Ward J	Doctor room number: G4
	

N.B. Please note that Doctor name represents either:

- The Patient's registration doctor.
- OR
- The Patient's appointment doctor.

(18 marks)

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

B5.

Consider the following additional information about the local health centre system described in the case study:

“There are two types of doctors; full time doctors and visiting doctors. The following data should be stored about every full time doctor:

- Doctor number
- Doctor name
- Doctor telephone number
- Doctor room number.

The attributes of each visiting doctor are:

- Doctor number
- Doctor name
- Doctor telephone number
- Next visit date
- Next visit duration.

An object of class Prescription consists of a header, a number of prescription lines, a doctor's signature.

- a) Explain the following relationships between classes using examples from the local health centre system to illustrate your answers. The examples should show relevant fragments of a class diagram.
- i) Association **(5 marks)**
 - ii) Aggregation or composition **(5 marks)**
 - iii) Generalisation/inheritance. **(5 marks)**
- b) Explain data validation and different kinds of data validation rules in database design. Give **TWO** examples of data validation rules based on the local health centre case study. **(10 marks)**

[Turn Over]