8. A new database-driven appointments system is being introduced in a medical centre.

    (a)   The developers begin by investigating the hardware and software required for running this system.

        State the type of feasibility being investigated.   **1**

    (b)   The appointments system will allow admin staff to make appointments, edit appointments or cancel appointments. In addition, medical staff will also be able to view patient notes and, if required, they can add details to a patient's notes.

        Draw a UML use case diagram for the appointments system.   **3**

[Turn over

The database will store details of patients, appointments, doctors and notes in the four entities shown below.

Patient	Appointment	Staff	Notes
patientID	patientID*	staffID	notesID
patientFirst	staffID*	staffFirst	comments
patientLast	dateApp	staffLast	
contactNumber	timeApp	staffType	
patientType	appointmentType		
notesID*			

(c) The data dictionary for the Appointment entity is shown.

Entity: Appointment					
Attribute name	Key	Type	Size	Required	Validation
patientID	PK/FK	varchar	6	Yes	Existing patientID from Patient table
staffID	PK/FK	integer		Yes	Existing staffID from Staff table
dateApp	PK	varchar	10	Yes	
timeApp	PK	varchar	5	Yes	
appointmentType		varchar	30	Yes	

The developers decide to replace the primary key of the Appointment entity with a surrogate key called appointmentID.

Describe two benefits of using a surrogate key for the Appointment entity of the database.   **2**

(d) The `patientType` field for patient GS0901 contains the value Child.

This patient has now reached the age of 18 and the contents of the `patientType` field must be updated from Child to Adult.

The following query is used to update the relevant record by first checking that the specified record is already in the database.

```
UPDATE Patient
SET patientType = "Adult"
WHERE patientID = "GS0901"
AND _____ ;
```

Write the SQL clauses needed to complete this query.   **2**

8. (continued)

The updated `Appointment` table is shown below, together with the other tables of the database.

Patient
patientID
patientFirst
patientLast
contact
patientType
notesID*

Appointment
appointmentID
patientID*
staffID*
dateApp
timeApp
appointmentType

Staff
staffID
staffFirst
staffLast
staffType

Notes
notesID
comments

(e) The medical centre runs group physiotherapy classes for adult and senior patient types.

Appointments for these classes are recorded in the `Appointment` table with the value of the `appointmentType` field set to 'Physiotherapy class'.

A query is required to display dates when more than 10 patients, who are not children, are attending a group physiotherapy class from 27 May to 31 May 2024.

The design of this query is shown below.

Field(s)/calculations	Date
Tables(s) query(-ies)	Appointment, Patient
Search criteria	Count(*) greater than 10, appointment type is Physiotherapy class age >= 18 dates from 27 May to 31 May 2024
Grouping	Date
Having	
Sort order	

This design is not fit for purpose.

(i) Identify problems with the design and describe how those problems could be resolved. **2**

(ii) Using a suitable Advanced Higher logical operator, write the SQL clause that would be needed to specify the date range in the implemented query. **1**

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8. (continued)

(f) Sample data from the `Appointment` table is shown below.

appointmentID	patientID	staffID	dateApp	timeApp	appointmentType
3461271	AL0121	1	09/06/2024	09:00	Physiotherapy class
3461272	PC0123	2	09/06/2024	10:30	Doctor appointment
3461273	DS0099	3	12/06/2024	13:30	Vaccination
3461274	BN0021	1	12/06/2024	14:00	Physiotherapy class
3461275	PC0123	2	12/06/2024	09:45	Nurse appointment
3461260	AL0121	1	12/06/2024	10:00	Doctor appointment
3461277	GS0249	2	13/03/2024	14:30	Nurse appointment
3461278	SW0671	3	14/06/2024	11:15	Physiotherapy class
3461279	BN0021	1	14/06/2024	12:00	Vaccination

One of the SQL queries used in the appointments system is shown below.

```
SELECT dateApp
FROM Appointment
WHERE staffID = 2
AND dateApp = ANY (
    SELECT dateApp
    FROM Appointment
    WHERE staffID = 1 )
```

Using the sample data provided:

  (i) state the output returned from the subquery   **1**

  (ii) state the output returned from the query.   **1**

8. (continued)

(g) The database system will integrate with a webserver to allow users to access the data through a web interface.

A wireframe of the appointments system's search facility is shown below.

```
┌─────────────────────────────────────────────┐
│ Appointments System              ▢▢▢         │
│  ┌──────┐                                     │
│  │╲  ╱ │                                     │
│  │74 x 71│    Centre Name                     │
│  │╱Logo╲│                                     │
│  └──────┘                                     │
│                                               │
│  Search Appointments                          │
│                                               │
│  Surname* │ text              │               │
│  Date of Birth* │ dd/mm/yyyy       │          │
│  ┌────────┐                                   │
│  │ Search │                                   │
│  └────────┘                                   │
└─────────────────────────────────────────────┘
```

During the implementation stage of the development process, the form code below is produced.

```
Line 1    < form _____  >
Line 2    Surname *
Line 3    < input type="text" value="text" name="surname" required >
Line 4    < br >
Line 5    Date of Birth *
Line 6    < input type="date" value="dd/mm/yyyy" name="dob" required >
Line 7    < br >
Line 8    < input type="submit" value="Search" >
Line 9    < /form >
```

Complete the code needed at line 1 to send data gathered using this form securely to a page called `search.php`.

2