# Business Systems Design and Analysis
# Final Project

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ISM 4113

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## Stage 1: System Descriptions

a) EasyBook is a mobile and tablet information system for small businesses and service providers to manage client bookings easily on a smartphone or tablet. Clients can view open time, book or cancel an appointment and are reminded automatically. Owners of the business can make bookings, change availability, and view current calendars on a daily basis. EasyBook seeks to provide scheduling as an easy, efficient, and paperless process.

| *Attribute* | *Description* |
|---|---|
| **Input** | Customer information (name, contact), chosen service, date, and appointment time. |
| **Output** | Confirmation message, appointment details, notifications, and daily schedules for staff. |
| **Boundary** | The system boundary includes the users (clients and business owners), communication is to be done and appears in the mobile app, and the information stored in an internal to the business database. The business is using external systems (like payment systems) jammed within the business's broader systems. |
| **Environment** | Mobile devices accessing the app (Android/iOS), cloud database, and the internet. |
| **Components** | Mobile interface, scheduling module, and database (appointments, users, services), and notification module. |
| **Interrelationship** | Users provide information and the scheduling module stores this information in the database where this collected information is able to appear as data dashboards and confirmation messages that are displayed to the user. |
| **Purpose** | The purpose is to create a quick appointment scheduling system, to minimize scheduling conflicts, and to improve customer satisfaction. |
| **Feedback** | Automatic notifications to users, confirmation messages sent out to users and user reviews collected after the appointment to use moving forward as a business. |
| **Constraints** | Requires internet connection to use the app, and needs to address each and every aspect of data security and privacy. |

b) Zhao, Yoo, Lavoie, Lavoie, and Simoes (2017) conducted a study where 36 papers reviewed twentyone different Web-based appointment scheduling systems. They believed that using an online scheduling system has many positive experiences, such as a decreased no-show rate, reduced time to see a staff member, less burden on office staff burdens, and improved experience reported by users. However, they also identified obstacles to adopting and implementing an online scheduling system, such as cost, inflexibility, data security, and comfort with technology by patients. Despite these issues, the study found a clear shift towards the use of Web-based appointment systems due to their potential to improve efficiency and accessibility. The findings of the study in general are consistent with the EasyBook mobile appointment system's intention to provide a simple and efficient way of booking appointments by businesses and customers using a mobile system.

## Stage 2: Data Flow Diagram (DFDs)

### A. Develop a Level-0 DFD

The Level-0 DFD indicates the major processes, data stores, external entities, and the data flows between them.

**Minimum Requirements Check:**

- Minimum **2 data stores** → The system has **3** data stores: **D1, D2, and D3**.
- Minimum **3 processes** → We have 3 main processes defined: **1. Client Booking Management,** **2. System Data Maintenance,** and **3. Notification Generation.**
- Minimum **1 source** → The **Client** is the main data source (the initiator of the requests).
- Minimum **1 sink** → The **Business Owner** is a data sink (the recipient of reports), and the Client is also a data sink (as the recipient of notifications).

**Proposed Elements for EasyBook Level-0 DFD:**

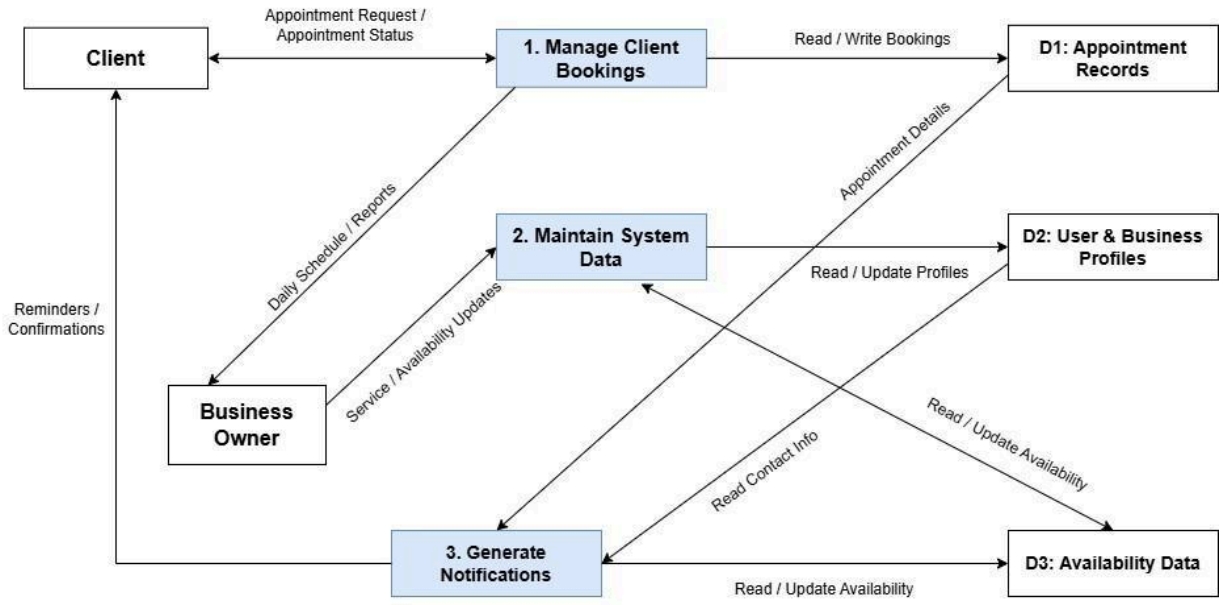
| Element Type | Name | Role in EasyBook |
|---|---|---|
| **External Entity (Source/Sink)** | **Client** | Requests for appointments, receives confirmation/reminder. |
| **External Entity (Source/Sink)** | **Business Owner** | Responsible for managing information relative to the service, reviewing the daily schedule, and managing availability. |
| **Process 1** | **1. Manage Client Bookings** | Responsible for the core scheduling logic of booking, modifying, or canceling reservations. |
| **Process 2** | **2. Maintain System Data** | Responsible for changes made to the business profile, services, and the availability setting. |
| **Process 3** | **3. Generate Notifications** | Responsible for sending automated confirmations, reminders, and follow up messages. |
| **Data Store 1** | **D1: Appointment Records** | Stores each booking, including the Client ID, Service, Date/Time, and Status. |
| **Data Store 2** | **D2: User & Business Profiles** | Stores client contact information, owner login credentials, and services stored in a business. |
| **Data Store 3** | **D3: Availability Data** | Stores the current open and blocked time periods for the business. |

**DFD Level-0 Narrative:**

The EasyBook system's Level-0 DFD represents its three primary functional areas. The external entity **Client** issues an Appointment Request to **Process 1: Manage Client Bookings**, and the Client receives the Appointment Status back. The **Business Owner** issues **Service/Availability Updates** to **Process 2:**

**Maintain System Data** and requests the Daily Schedule/Reports from Process 1. **Process 3: Generate**

**Notifications** draws **Appointment Details** from **D1: Appointment Records** in order to output Reminders/Confirmations to the **Client**. All three processes utilize the data stores in order to maintain scheduling and user information.




## B. Develop a Level-1 DFD

The **Process 1: Manage Client Bookings** has been decomposed below into a Level-1 DFD while maintaining balance by keeping the original external data flows (in and out of the system) the same.

**Minimum Requirements Check:**

- Minimum **2 data stores** → this diagram employs **D1: Appointment Records** and **D3: Availability Data** (D2 is also included so be validated).
- Minimum **2 processes** → **Three** subprocesses (1.1, 1.2, and 1.3) have been used.

**Decomposing Process 1: Manage Client Bookings**

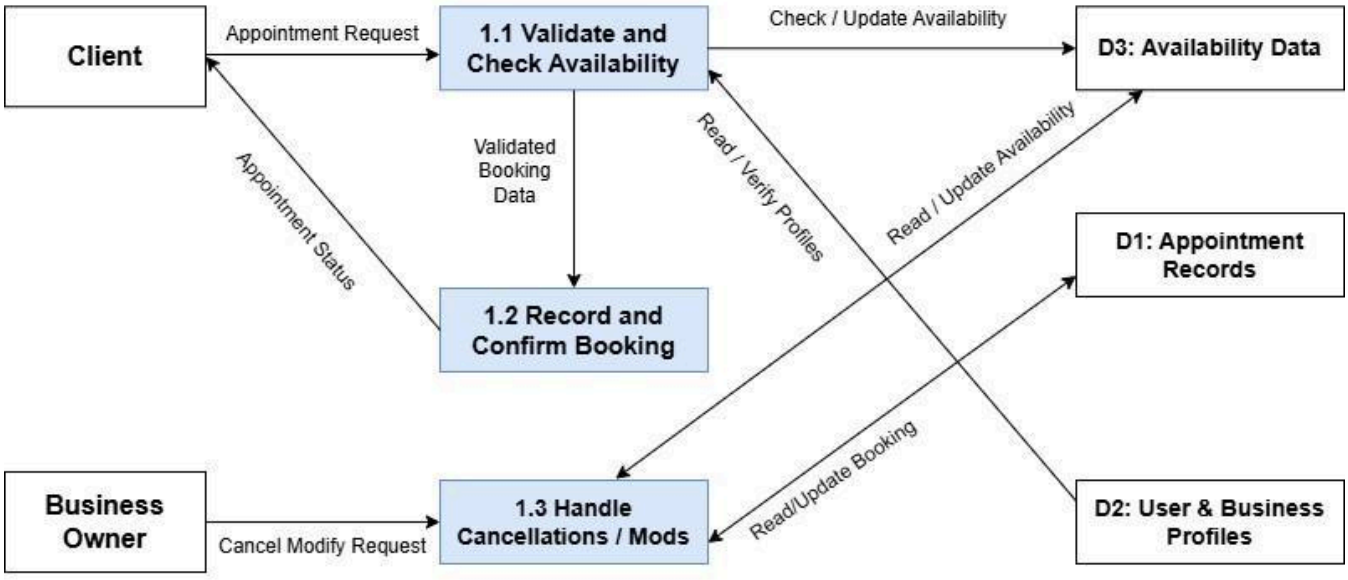
| Sub-Process | Name | Role in DFD |
|---|---|---|
| **1.1** | **Validate & Check Availability** | Receives an *Appointment Request* (*Client*). Reviews **D3: Availability Data** and **D2: User & Business Profiles** to confirm the service and time. |
| **1.2** | **Record & Confirm Booking** | Receives **Validated Booking Data** (from 1.1). Logs the appointment in **D1: Appointment Records** and notifies the **Client** of the *Appointment Status.* |
| **1.3** | **Handle Cancellations/Mods** | Receives *Cancel/Modify Request* (Business Owner). Modifies **D1: Appointment Records** and **D3: Availability Data**. (Refs D2 to verify profile if needed). |

## DFD Level-1 Narrative:

The Level-1 DFD provides a detailed breakdown of **Process 1: Manage Client Bookings.** Once the Client submits an Appointment Request, it goes into **Process 1.1: Validate & Check Availability** and validates the appointment request by consulting **D3: Availability Data** on the schedule, but also by referring to **D2: User & Business Profiles** to verify that the Client/service is eligible for an appointment. Once validated, the appointment request moves to **Process 1.2: Record & Confirm Booking**. Process

1.2 will read and write to **D1: Appointment Records** where the record will be stored, and return a final

Appointment Status to the Client. Separately, the **Business Owner** can take action on modifies or cancels by submitting a request through the Cancel/Modify Request flow into **Process 1.3: Handle Cancellations/Mods**. Process 1.3 reads/writes data to D2 to access the profiles and will initiate data updates against **D1** and **D3** as appropriate. As with the Level-0 diagram, this decomposition preserves balance.




## C. Develop a Level-2 DFD

The Level-1 **Process 1.2: Record & Confirm Booking** is further detailed in a Level-2 Data Flow Diagram (DFD), maintaining balance by containing identical external data flows from the parent process.

**Minimum Requirements Check:**

- Minimum **2 data stores → D1: Appointment Records** and **D3: Availability Data** are included in the diagram.

- Minimum **2 processes → Three** subprocesses (1.2.1, 1.2.2, and 1.2.3) are included as the process detail logic for confirming the booking.

**Decomposing Process 1.2: Record & Confirm Booking**

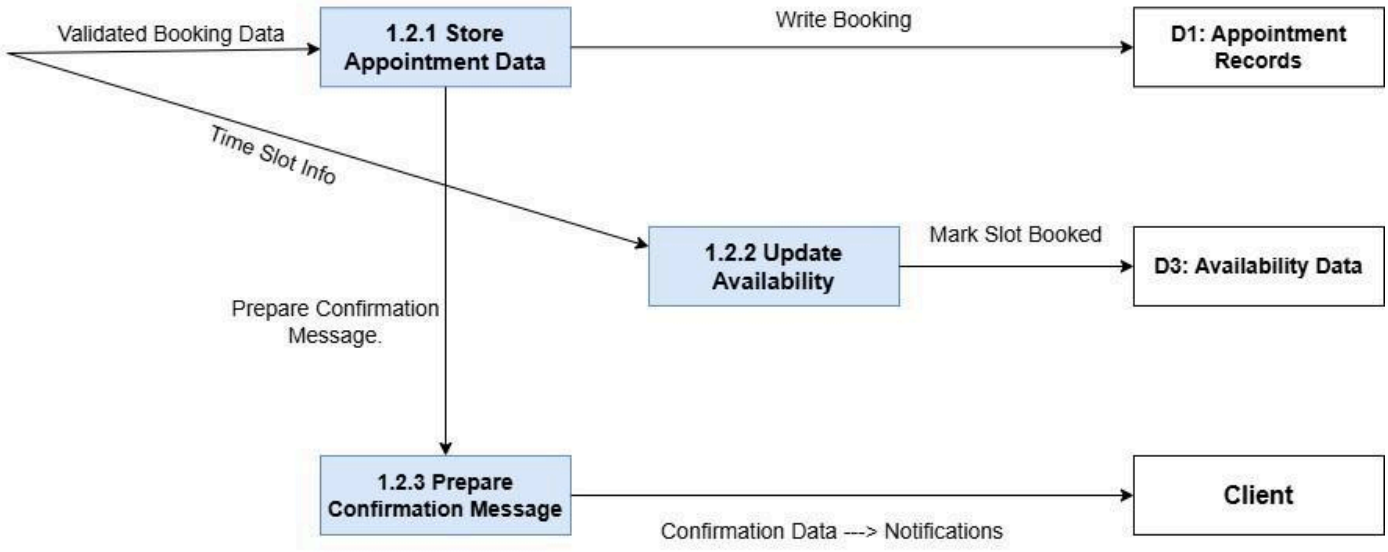
| Sub-Process | Name | Role in DFD |
|---|---|---|
| **1.2.1** | **Store Appointment Data** | Obtains Validated Booking Data and writes the full record into **D1: Appointment Records.** This action will create the New Booking Record that will be needed by process 1.2.3. |
| **1.2.2** | **Update Availability Slot** | Obtains Time Slot Info in conjunction with 1.2.1 into **D3: Availability Data** using a column for 'Booked' status for that specific time slot. |
| **1.2.3** | **Prepare Confirmation Message** | Obtains the New Booking Record from 1.2.1, creates the message, and sends the final Confirmation Data directly to the external entity **Client**. |

## DFD Level-2 Narrative:

The Level-2 DFD for Process 1.2: Record & Confirm Booking encompasses a three-step process that starts with the arrival of the **Validated Booking Data** from Process 1.1, and then promptly branches into two parallel flows. The record is then stored: the complete record is routed to **Process 1.2.1: Store Appointment Data**, where the data is persisted - the full appointment details are passed via the Write

Booking flow to **D1: Appointment Records**; concurrently, the slot information is transferred as Time Slot Info to **Process 1.2.2: Update Availability Slot** to update **D3: Availability Data** and prevent

double-booking of appointments. When the record is stored, there will be a new New Booking Record generated by Process 1.2.1 for **Process 1.2.3: Prepare Confirmation Message** to produce the end result - the Confirmation Data will be sent to the external early on, **Client**.




**Stage 3: Entity-Relation (E-R) Diagrams**

## A. E-R Diagram

The Entity-Relationship (E-R) diagram corresponding to EasyBook has been developed around six fundamental entities which depict all the principal data elements recognized during the problem analysis at Stages 1 and 2. The entities are: Client, Business, Service, Appointment, Availability Slot, and Review.

Each entity has the subsequent attributes:

**CLIENT**

- *Client_ID* (Primary Key)
- Name
- Email
- Phone

**BUSINESS**

- *Business_ID* (Primary Key)
- Name
- Location

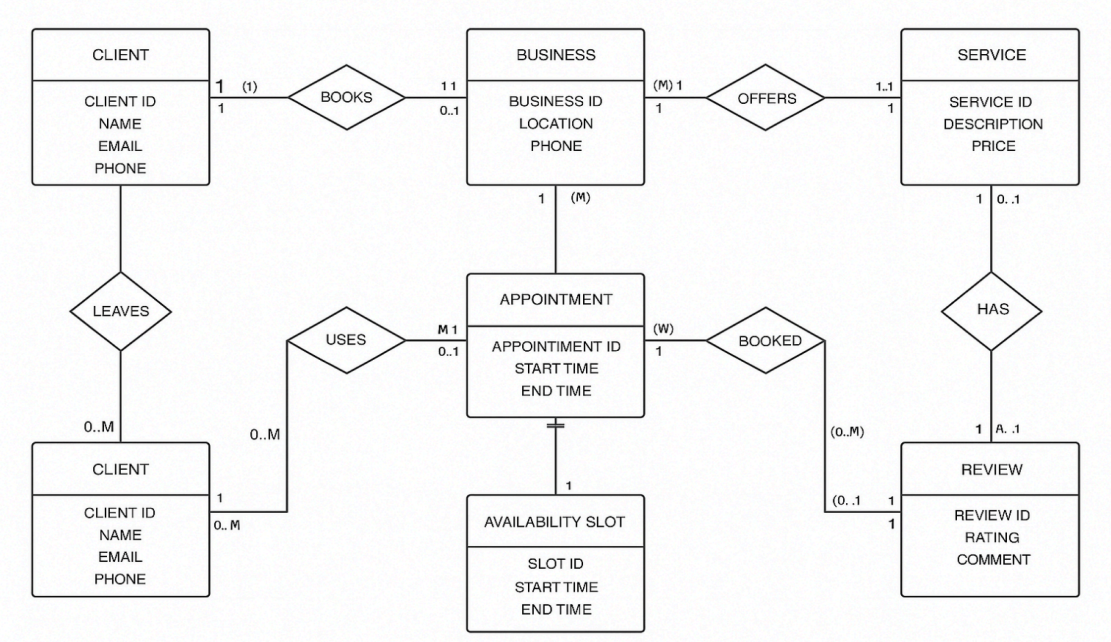
- Phone

**SERVICE**
- *Service_ID* (Primary Key)
- *Business_ID* (Foreign Key)
- Description
- Price

**APPOINTMENT**
- *Appointment_ID* (Primary Key)
- *Client_ID* (Foreign Key)
- *Service_ID* (Foreign Key)
- *Slot_ID* (Foreign Key)
- Status

**AVAILABILITY_SLOT**
- *Slot_ID* (Primary Key)
- *Business_ID* (Foreign Key)
- Start_Time
- End_Time

**REVIEW**
- *Review_ID* (Primary Key)
- *Client_ID* (Foreign Key)
- *Business_ID* (Foreign Key)
- Rating
- Comment



## B. E-R Diagram Description

The E-R diagram representing EasyBook showcases the interactions between clients, beauty businesses, services, appointments, time-slot availability, and customer reviews.

A **Client** can make several **Appointments**, thus a **mandatory one-to-many** relationship is formed. An appointment is linked to a single client. Clients can also leave **Reviews** which lead to an **optional zero-to-many** relationships because a client might decide to give one or more reviews or none at all.

A **Business** offers various **Services**, hence a **mandatory one-to-many** relationship is established; every service must be linked to one and only one business. Besides, businesses get Reviews from clients, thus they have an **optional-many** relationships with the Review entity.

Each **Service** can be involved in several appointments at the same time, thus a **mandatory one-to-many** relationship between services and appointments is created. Every appointment has to link to a service.

The **Availability Slot** entity keeps track of the times when a business is ready to take appointments. An availability slot could either be filled or left empty, hence an **optional zero-to-many** relationships between Availability Slot and Appointment exists. Nevertheless, each appointment must be assigned to one and only one availability slot, thus a **mandatory one** requirement is imposed on the Appointment side.

The Review entity finally connects Clients and Businesses by recording client feedback. Reviews are associated with both Client and Business in a mandatory one way as each review must be related to one specific person and one specific business.

The model includes all cardinality types required:

- **Mandatory one:** Appointment → Client
- **Mandatory many:** Business → Service
- **Optional 0 or 1:** Appointment → Availability Slot (on the slot side)
- **Optional many (0..M):** Client → Review

**C. Cardinality Assumptions and Justifications**

The cardinalities selected for this E-R diagram are based on the functional requirements described in Stages 1 and 2:

1. **Client to Appointment (Mandatory 1-to-Many)**

   To create an appointment, it is necessary that a client already exists, and one client can arrange many appointments. This is the manner in which most booking systems work where the client can make several bookings in the future.

2. **Business to Service (Mandatory 1-to-Many)**

   A business must possess at least one service for the system to operate. Services cannot come into existence without a business owner thereby enforcing a one-to-many relationship that is mandatory.

3. **Service to Appointment (Mandatory 1-to-Many)**

   Each appointment will always be associated with one service only and different customers may book the same service at different times. Thus, a one-to-many relationship is formed.

4. **Availability Slot to Appointment (Optional Zero-to-Many)**

   The time slots are the creation of the businesses but they may not necessarily get the booking. Thus, a slot can have no appointments at all. Nonetheless, each appointment can only take place within one slot.

5. **Client to Review (Optional Zero-to-Many)**

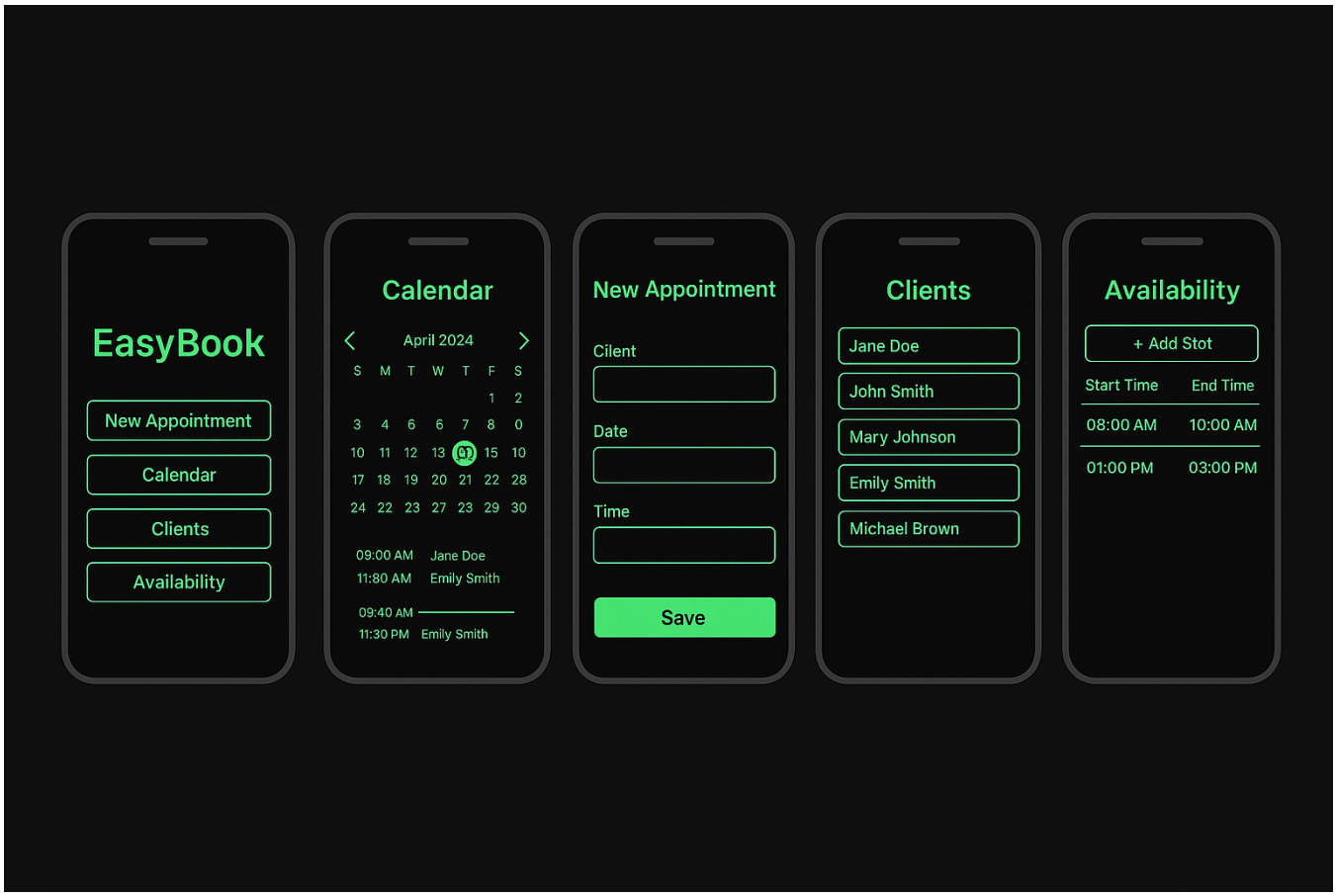
   It is not mandatory for Customers to write reviews, but they can submit a lot of reviews if they want to do so.

6. **Business to Review (Mandatory 1-to-Many)**

   It is required that every review must be related to a particular business that is being criticized. A

business can collect an unlimited number of reviews, but then each review must be connected to one specific business.

**Stage 4: User Interface Design**




The user interface of EasyBook was developed to deliver an uncomplicated, user-friendly, and extremely accessible experience to both the clients and the business owners. Since the system is aimed at mobile and tablet users, the design is in accordance with the latest app design trends that include clean screens, large touch-friendly buttons, and light mental effort for the user. Every screen has a unified black background with neon green highlights which not only creates a strong visual contrast but also helps in reading easily in bright as well as low light conditions.

**1. Main Window**

The Main Window is the core navigation point of the system. The design includes large and high-contrast navigation buttons so that the users can select their desired function quickly with very little scrolling. Users are welcomed by a tiny header which helps them to navigate through the system while the four principal options - Schedule Appointment, Calendar, My Clients and Availability - are clearly displayed one by one for a better comprehension. This type of arrangement not only cuts down on time spent navigating, but also makes it easier for those who are not very tech-savvy to get into the system.

**2. Calendar View**

The Calendar View features a clean grid layout that shows both open and booked time slots. The days and hours are clearly marked, as well as the neon highlighting which makes the available times very easy to spot. Users can click on any free slot to start the scheduling process, and the appointments show up in organized blocks with clearly readable starting and ending times. The interface is designed to be simple without cluttering and only the necessary information regarding scheduling is displayed, thus making the users less tired with their decision-making.

**3. Appointment Form**

The Appointment Form is designed for quick and accurate data entry from mobile devices using a straightforward single-column layout. Large, user-friendly input areas are employed for all fields—Client Name, Service, Date, Start Time, and End Time. Typing errors are reduced through the use of drop-down menus and calendar pickers. The "Save Appointment" button, which is brightly illuminated in neon green, not only denotes the accomplishment but also lessens the likelihood of accidental omission.

**4. Client List**

The Client List consists of a searchable and alphabetically arranged list of all clients. Each client has a clean card-style layout and their name, phone number, and email are displayed. Pressing on a client gives access to further management options. This is particularly useful for business owners as they can quickly get the client information they need without going through complex menus.

**5. Availability Manager**

One tool is called Availability Manager and it is where businesses can customize appointment schedule time. The interface presents availability in a clear timeline format, with the active availability being shown by bright green blocks. Users can perform availability operations like adding, changing, or deleting through the use of simple button controls, and thus one does not need to worry about the time taken for the updates to be done—they can be done even in the busiest hours of the business. The design of the system is such that it is easy to understand and edit, so that there will not be any conflicting schedules.

**User-Friendly Design Features**

The UI has implemented some major usability principles throughout all screens:

- **Consistency:** All screens have similar color scheme, typography and layout structure.
- **High contrast:** The black-and-neon combination is very readable and helps to avoid visual fatigue.
- **Touch-friendly elements:** Buttons and fields have sizes that enable easy tapping on mobile devices.
- **Minimal data entry:** Users' input is reduced by using drop-downs, pickers and predefined options.
- **Clear navigation:** The Main Window allows access to all important functions directly without having to go through deep menu levels.
- **Feedback cues:** The system's responses are made clearer to users by means of highlighted selections, confirmation buttons and visually distinct inputs.
- **Error prevention:** The use of structured forms and controlled input types leads to fewer errors during the process of booking or changing appointments.

## Stage 5: Database Design using Microsoft Access

**A.**

Based on the EasyBook E-R diagram developed in Stage 3, the following relational schema represents the tables generated using standard ER-to-Relational mapping rules.

**1. CLIENT Table**

**Primary Key:** Client_ID
**Attributes:**

- Client_Name
- Email
- Phone

**Relationship Mapping:**

- *CLIENT books APPOINTMENT*: Client_ID appears as a **foreign key** in APPOINTMENT.

**2. BUSINESS Table**

**Primary Key:** Business_ID
**Attributes:**

- Location
- Phone

**Relationship Mapping:**

- *BUSINESS offers SERVICE*: Business_ID appears as a **foreign key** in SERVICE.
- *BUSINESS manages AVAILABILITY_SLOT*: Business_ID appears as a **foreign key** in AVAILABILITY_SLOT.
- *BUSINESS schedules APPOINTMENT*: Business_ID appears as a **foreign key** in APPOINTMENT.

**3. SERVICE Table**

**Primary Key:** Service_ID
**Attributes:**

- Description
- Price

**Foreign Keys:**

- Business_ID → BUSINESS

**Relationship Mapping:**

- *SERVICE has REVIEW*: Service_ID appears as a **foreign key** in REVIEW.

**4. APPOINTMENT Table**

**Primary Key:** Appointment_ID
**Attributes:**

- Start_Time
- End_Time

**Foreign Keys:**

- Client_ID → CLIENT
- Business_ID → BUSINESS
- Service_ID → SERVICE
- Slot_ID → AVAILABILITY_SLOT

**Relationship Mapping:**
This table resolves multiple relationships:

- *CLIENT books APPOINTMENT*
- *APPOINTMENT uses AVAILABILITY_SLOT*
- *APPOINTMENT is booked for a SERVICE*

**5. AVAILABILITY_SLOT Table**

**Primary Key:** Slot_ID
**Attributes:**

- Start_Time
- End_Time

**Foreign Keys:**

- Business_ID → BUSINESS

**Relationship Mapping:**
Each slot belongs to one business and can be associated with zero or many appointments.

**6. REVIEW Table**

**Primary Key:** Review_ID
**Attributes:**

- Rating
- Comment

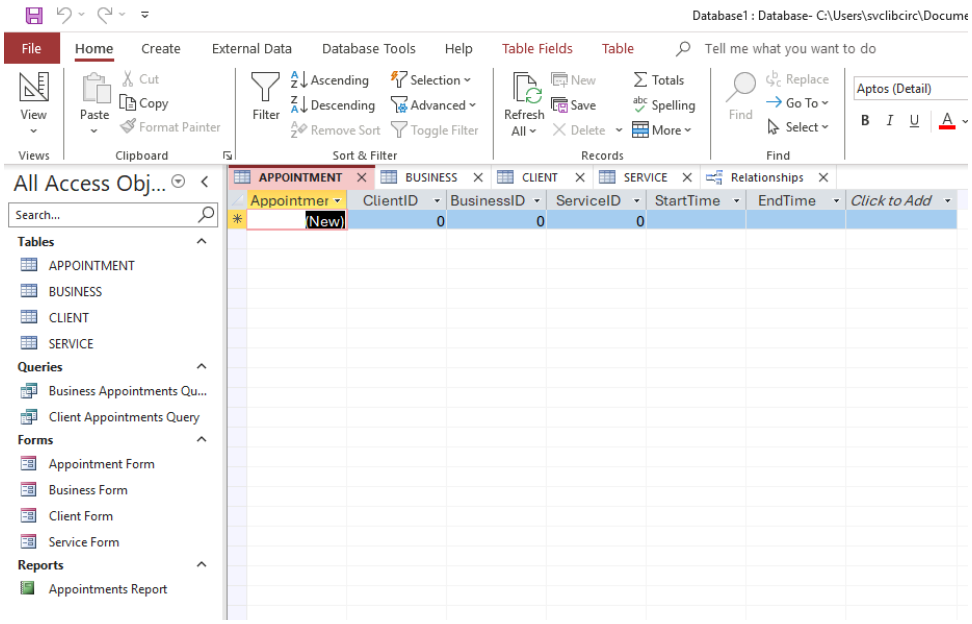
**Foreign Keys:**

- Client_ID → CLIENT
- Service_ID → SERVICE
- Appointment_ID → APPOINTMENT

**Relationship Mapping:**
Clients may leave a review for appointments they completed.

| Table Name | Primary Key | Foreign Keys | Notes |
|---|---|---|---|
| **Client** | **Client_ID** | - | Stores client info |
| **Business** | **Business_ID** | - | Stores business info |
| **Service** | **Service_ID** | Business_ID | Each service belongs to a business |
| **Availability_Slot** | **Slot_ID** | Business_ID | Business-defined availability |
| **Appointment** | **Appointment_ID** | Client_ID, Business_ID, Service_ID, Slot_ID | Main activity table |
| **Review** | **Review_ID** | Client_ID, Service_ID, Appointment_ID | One review per appointment |

**B.**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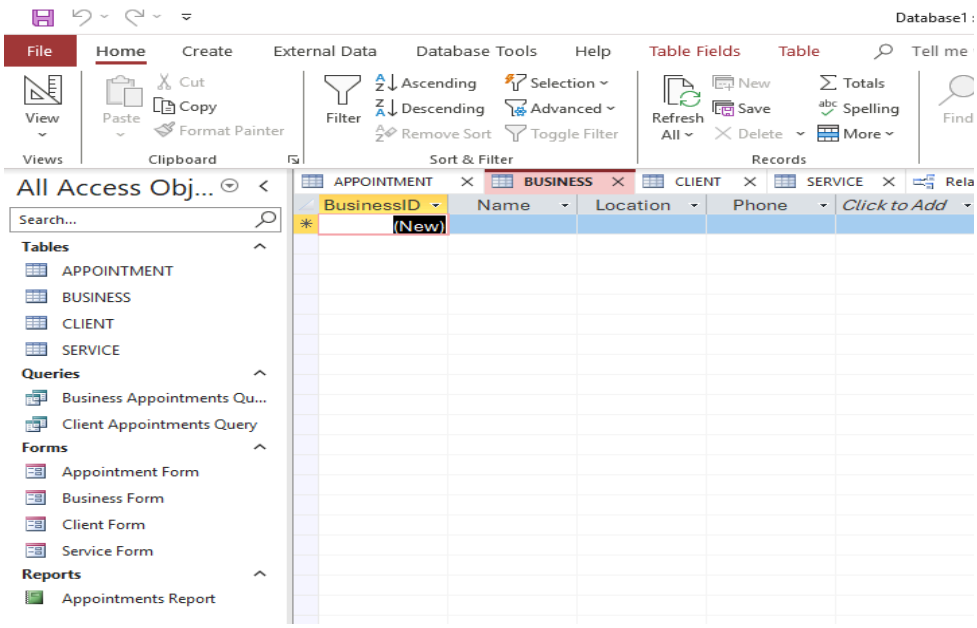
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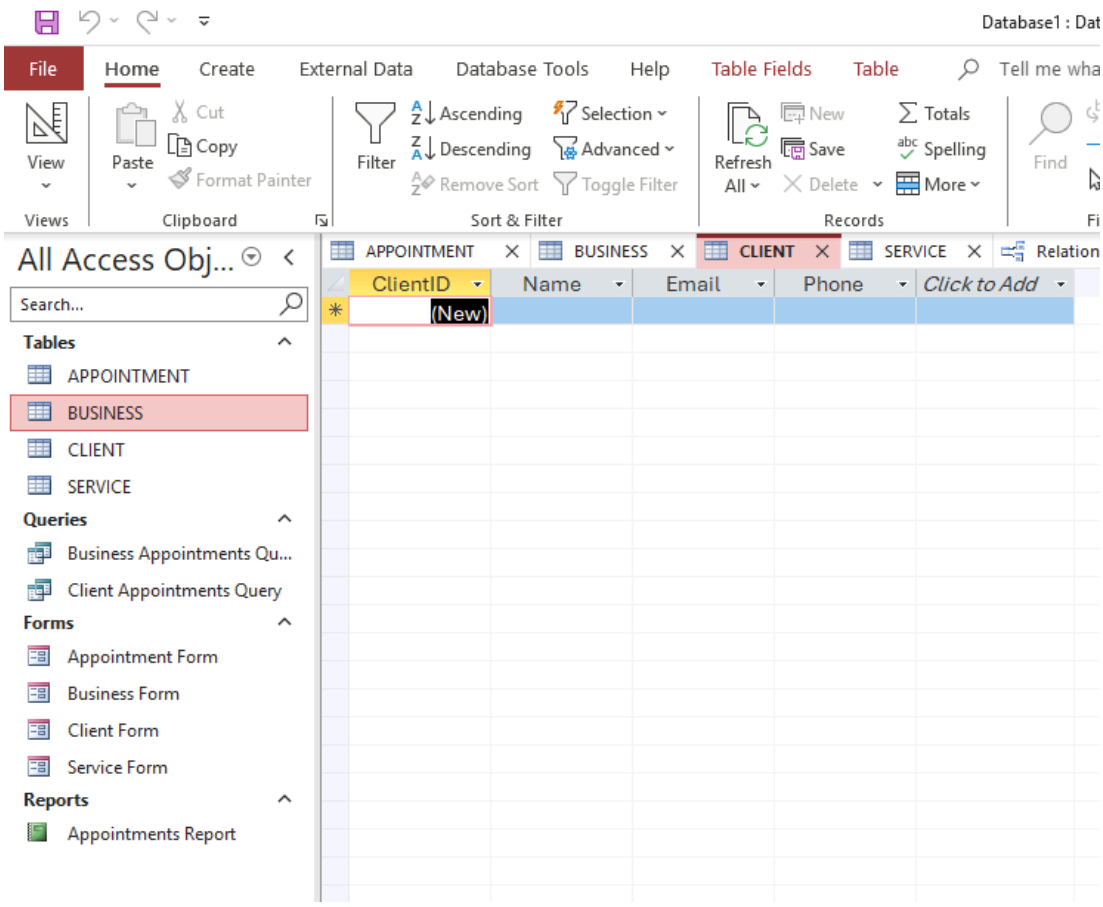
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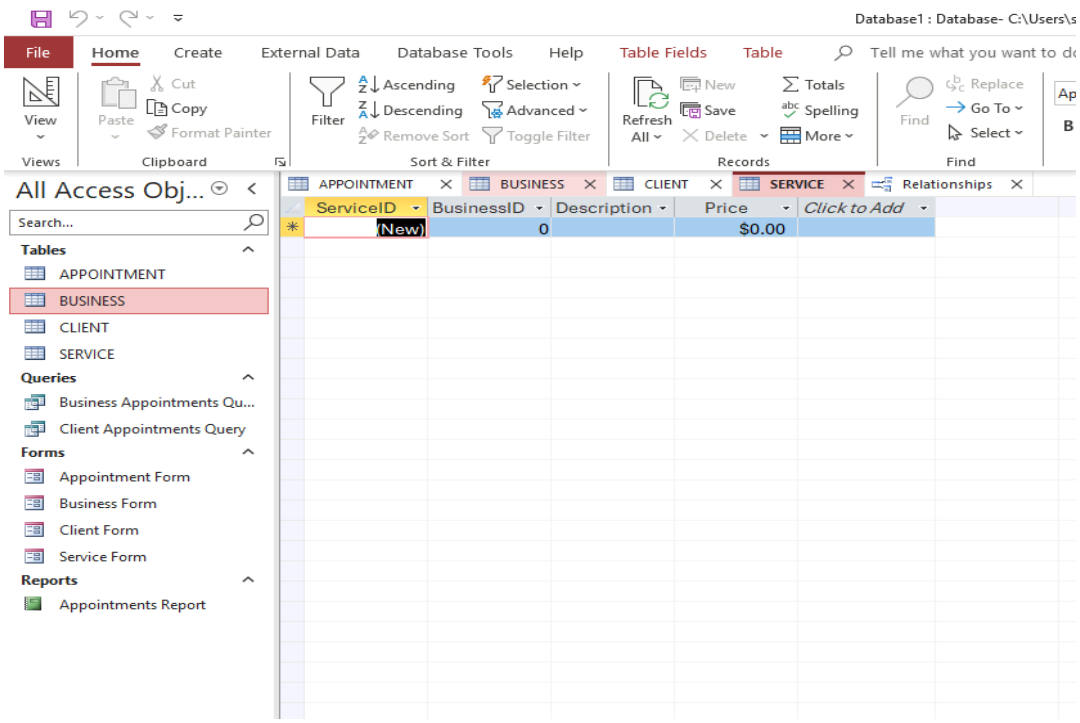
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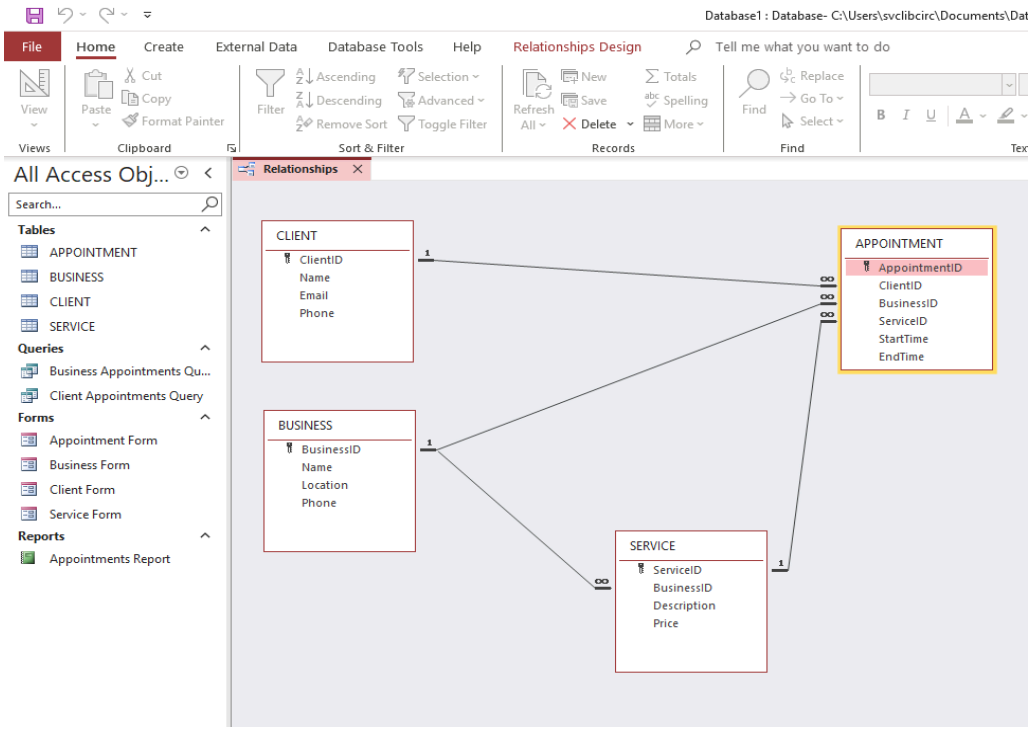
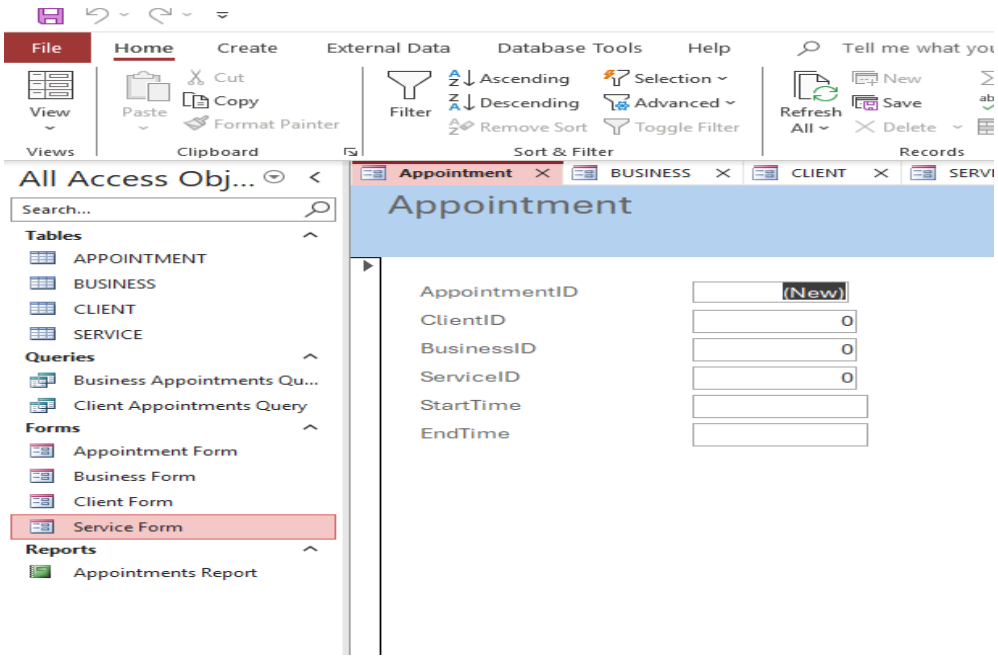
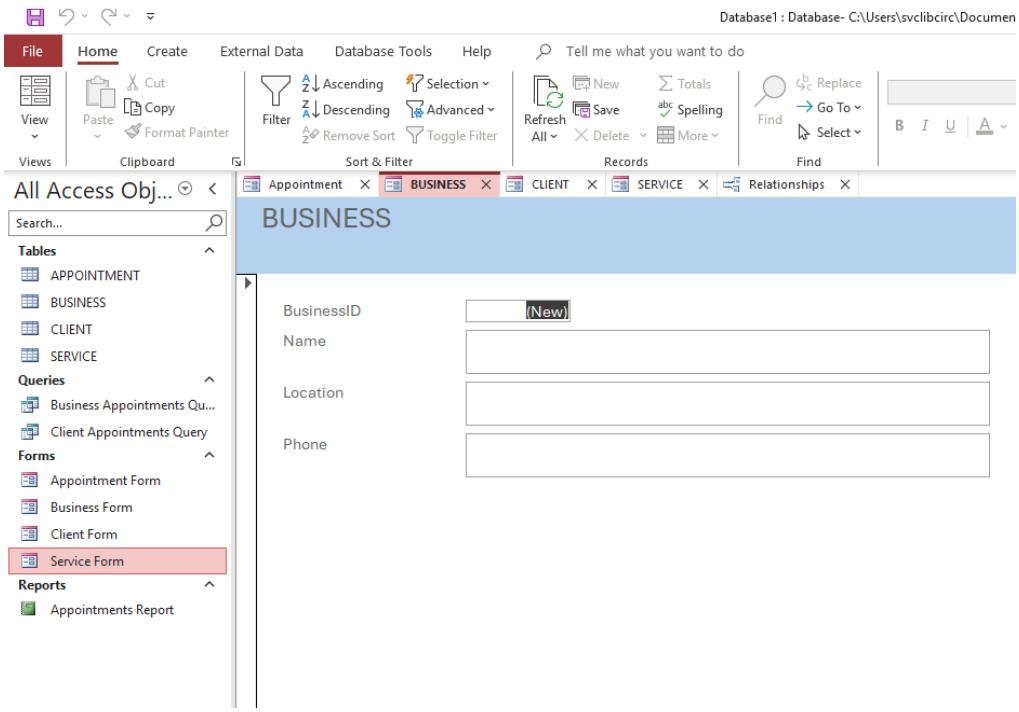
## Relationship Diagram




## Forms

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Business Form
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Reports
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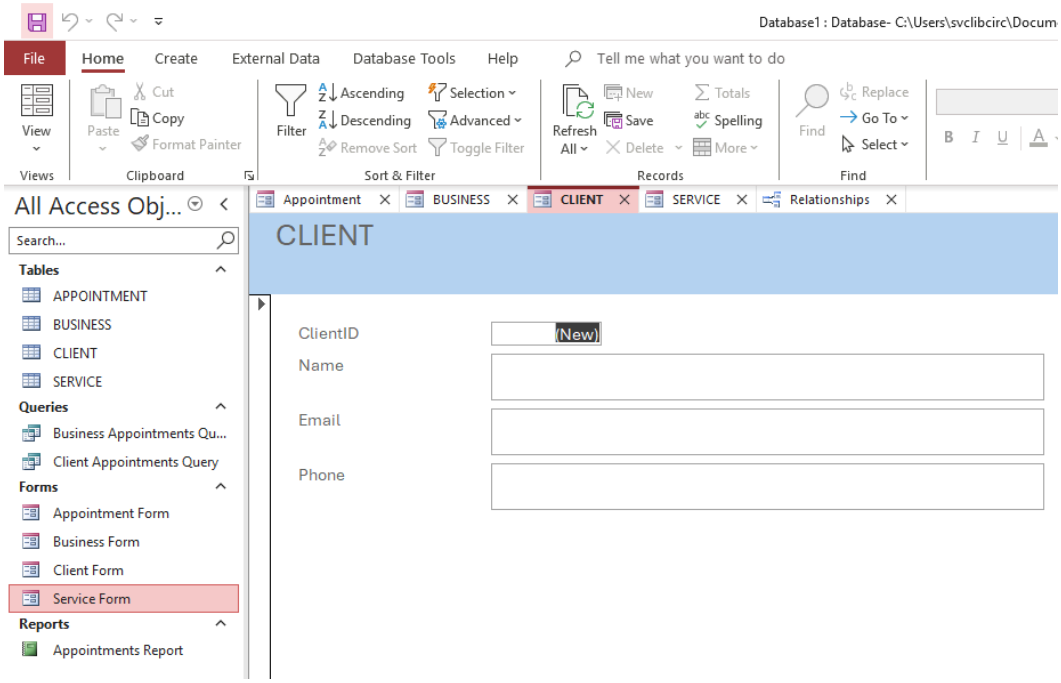
Phone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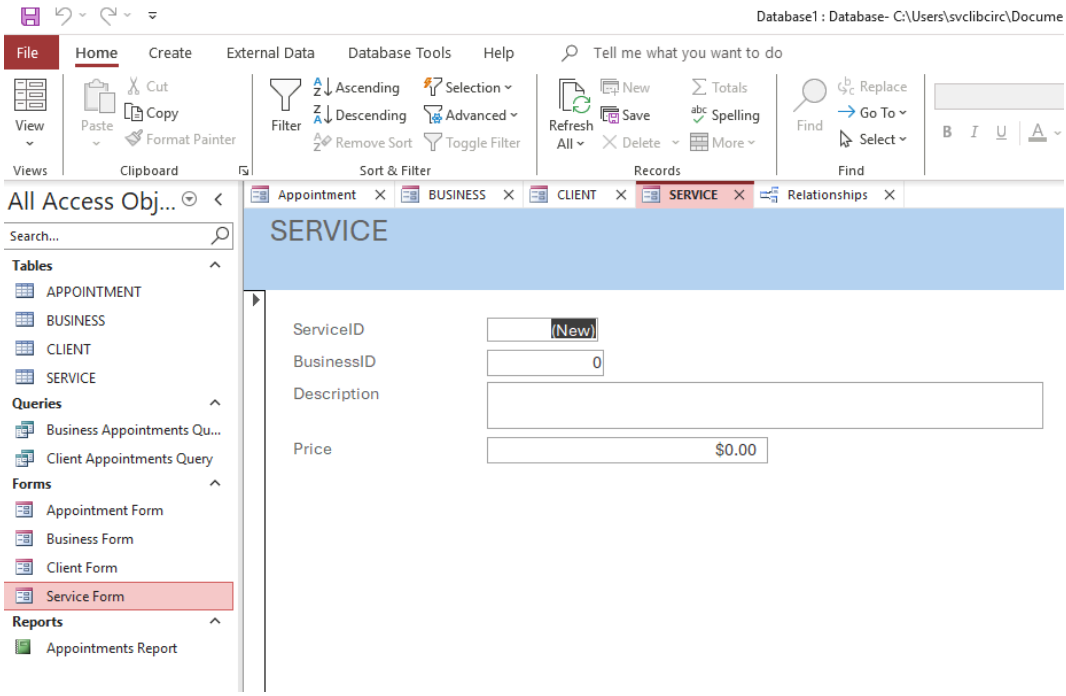
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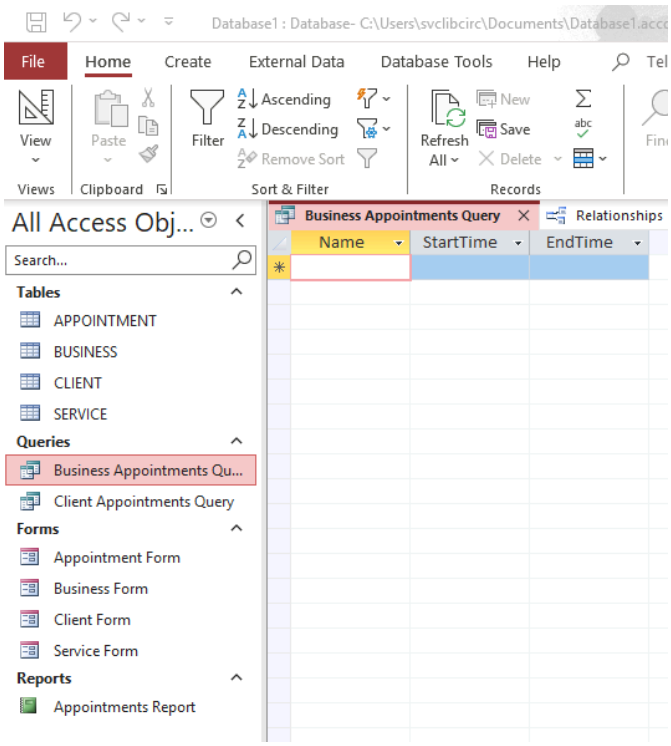
## Queries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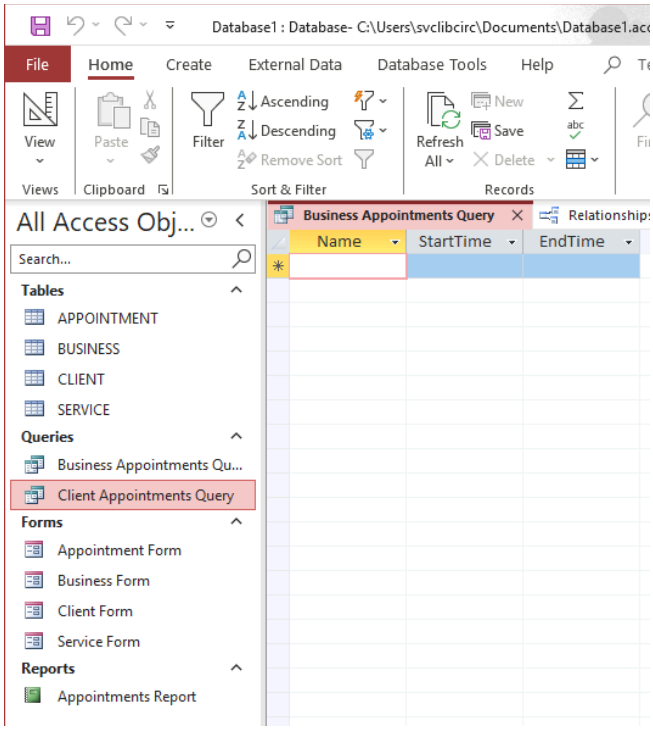
Relationships
Name
StartTime
EndTime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Relationships
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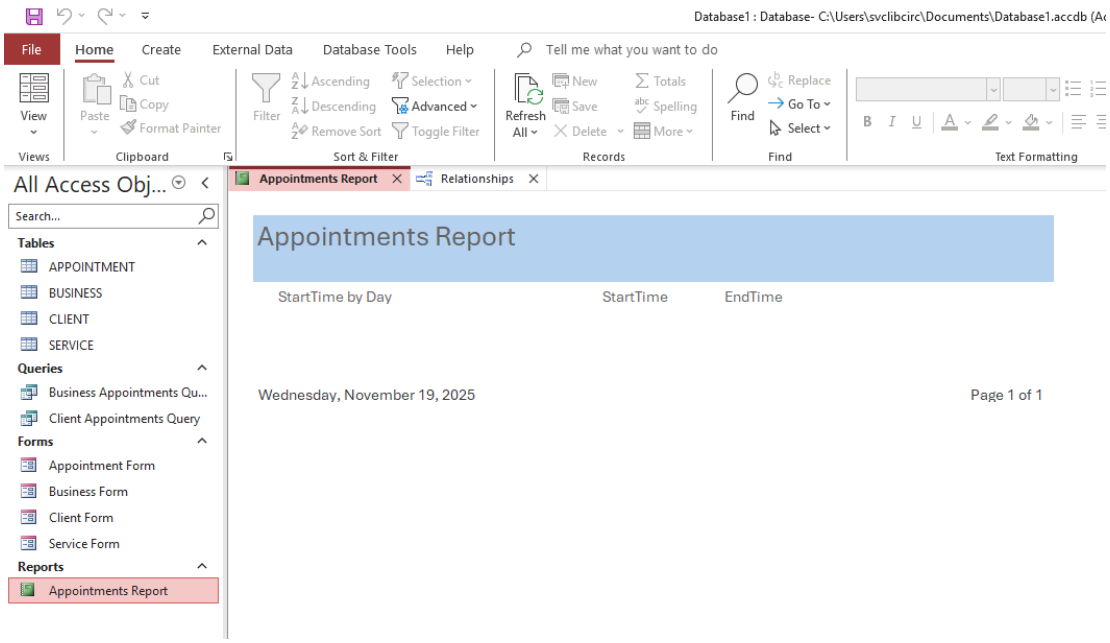
StartTime
EndTime

## Report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Appointments Report
Appointments Report
Relationships
Appointments Report
StartTime by Day
StartTime
EndTime
Wednesday, November 19, 2025
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