**Analysis Report of Group E Team**

Group Members: Bill Dai, Lucas Zhou, Ryan Jiang, Harry Cen

**Role Assignments:**

***-Entity Relationship Diagram (ERD) Design***

1. All team members contributed to Brainstorm and design the initial ERD structure, and formulate appropriate assumptions.
2. All members contributed to refine and polish the ERD.

***-Database Implementation***

1. All members contributed to build the basic structure and framework of the MySQL database.
2. Bill Dai and Lucas Zhou established relationships between all database tables by implementing Foreign Keys.
3. Bill Dai and Ryan Jiang generated and organized data for the database.
4. Bill Dai imported all data generated from Excel sheets into the database.

***-Queries for Management Information***

Harry Cen and Lucas Zhou each designed and implemented half of the management queries.

***-Website***

1. Ryan Jiang designed the wireframe for the website.
2. Harry Cen and Lucas Zhou, focused on writing HTML and CSS for customer, room, and other query pages.
3. Bill Dai Contributed to front-end and back-end code integration.

***-Analysis Report***

1. Ryan Jiang is the primary author of the report.
2. All team members contributed to polish and refine the analysis report.

**Understanding of the Business**

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***-Introduction:***

We break down the hotel’s business operations into various interconnected modules that manage hotel infrastructure, customer interactions, and operational workflows. The Hotel Structure module organizes information about hotels, buildings, floors, and rooms, defining their relationships and characteristics. Rooms are further categorized into two types, which is sleeping rooms and meeting rooms (their relationships are illustrated by “suite”), with attributes for availability, usage, and rates. The Customer and Reservation module tracks guest details, room reservations, and check-in/check-out times, ensuring efficient booking and occupancy management. The Billing and Service module handles charges, payments, and additional services provided to guests, linking these transactions to specific rooms. Additionally, The Event and Conference Management module facilitates organizing events, assigning hosts, booking meeting rooms, and managing event participants. Together, these modules provide a structured approach to managing a hotel’s operations, from infrastructure oversight to guest services, enabling better management and information retrieval.

***-General Assumptions:***

1. This database is picturing the state of company by the end of 2023.

2. Booker is the person who reserves the room, the host is the person who hosts the event, and the guest is the person who lives in the hotel. The three characters are independent.

3. Booker uses email as contact information to reserve a room, guests and hosts need to use phone numbers when they enter the hotel.

***-Hotel Infrastructure:***

The hotel’s physical structure is represented hierarchically through entities: hotel, building, wing, and floor. The four entities all above specific room which will be elaborated in the next section.

* **Hotel:** Captures general information such as hotelId, hotelName, location, and buildingNumber. Location is the physical location of the hotel and buildingNum is the number of the buildings the hotel incorporates.
* **Building:** Each hotel has multiple buildings with attributes buildingId, hotelId, wingsNum, and buildingName. Of which, hotelId is the foreign key, signifying with hotel the building is in. The wingsNum is the number of wings the featured building incorporates.
* **Wing:** Buildings are divided into wings identified by wingId and wingName. Additional details such as floorNum indicate the number of floors in each wing and buildingId is the foreign key, signifying with building the wing is in.
* **Floor:** Floors within wings are uniquely identified by florid, however this is not the actual floor number. This Table include attributes such as smoke (designating smoking policies for every room) and description showing the actual floor number.

This hierarchical structure enables efficient management of physical facilities and provides flexibility for room organization and customer preferences.

**Assumptions** over Hotel Infrastructure:

1. A Building is made up of several wings.
2. Whether a room is smoking or not is full dependent on the smoking status of the floor they are on; if a floor is smoking floor, then all rooms on that floor are smoking room, vice versa.
3. A hotel can have many buildings, a building can have many wings, and a wing can have many floors.

***-Room Types:***

Rooms in the hotel are categorized into three primary types: sleeping rooms, meeting rooms, and suites.

* **Sleeping Room:** Captures essential attributes including sleepingRoomId (not the actual room number), roomNumber, suiteId (indicates the suite the room belongs to), floorId, status, sleepingRoomRate, and furnitureDescription.
* **Meeting Room:** Meeting spaces include attributes such as meetingRoomId (not the actual room number), suiteId, roomNumber, toiletFacility (whether or not has a toilet facility), movableWall (whether or not has a movable wall), status, florid, meetingRoomRate, and furnitureDescription (includes tables, chairs, white boards, and rollaway bed etc.). Movable walls allow for flexible configurations to adjust seating capacity.
* **Suites:** Suites are unit of rooms that combines a sleeping and a meeting room, and only one room in suite has a door towards the outside. Attributes like suiteId and hallAccessingRoomId (indicates which room has the door towards the outside) highlight the interconnection with sleeping or meeting spaces.
* **Combined Room:** The combined\_room entity contains all rooms of both types, ensuring that interactions between rooms and other functions are effective.

**Assumptions** over Room Types:

1. In a unit of suite, there is only one hall accessing room, so one suite entity can represent the suite properly.
2. Not all rooms are in suites, thus, the suiteId attribute of rooms can be null.
3. sleepingRoomRate and meetingRoomRate are monetary rates that reflects cost of the room per night, which is only associated to the capacity of the room.
4. If there are separate hallway access doors to adjacent rooms (whether sleeping rooms or meeting-only rooms), the rooms are considered separate and can be allocated separately instead of a suite.
5. A sleeping room has all the facilities. Toilets and movable walls are optional in meeting rooms.
6. Sleeping rooms are allocated daily from 4 P.M. until 12 noon the next day.

***-Reservations and Billing:***

Reservations and billing processes are central to hotel operations, and the following entity are related to this part of operation:

* **Reservations**: Managed through the reservation entity, which includes details such as reservationDate, checkInDate, checkOutDate, deposit, booker, and specialRequest.
* **Booker**: The booker entity identifies the individual making the reservation, including id, name, and contact information.
* **Billing**: The billing entity tracks financial transactions, including paymentMethod, paid status, and associated charges beyond room fee.
* **Room Assignment**: The **room\_guest** entity connects guests to their rooms with details like moveInDateTime and moveOutDateTime.

**Assumptions** over Reservations and Billing:

1. For each reservation, there will only be one booker. This is why there is not joint table to show this connection.
2. For reservations, historical reservations have roomId because the owners of these reservations have checked in and rooms have been assigned to them. However, a room type will still be assigned to reservations with a future check in date.
3. Special request is not mandatory; thus, it can be null is the database.
4. Deposit is a fix amount depends on the room type the booker reserves ($100 for sleeping room and $200 for meeting room).
5. Reservation date is the date when the booker makes it and should be earlier than the actual move-in date.
6. In the billing entity, the paymentMethod and paymentTime attributes may remain null initially. This occurs because all bills generate in 2023 will be asked to pay at the end of the year, and paymentMthod and paymentTime will remain null for those bills that are not paid after the deadline
7. All the reservations in our database came from the year 2023. (but a guest can reserve a room with a start date in 2024)
8. A reservationId matches only one room. Booking multiple rooms match multiple reservationId. In other words, the relationship between reservation and booker is many-to-many.

***-Services and Billing:***

The hotel offers a variety of services beyond basic room reservations, which will also generate charges on associated billing account:

* **Service**: Managed through the service entity, which includes service type, charge, and the billing account it belongs to.
* **Billing Integration**: Services like meals, room service, health club usage, or business center charges are associated with specific rooms and its billing accounts.

***-Events and Hosts:***

The hotel caters to events and gatherings through the following relationships:

* **Event**: Managed through the event entity with attributes such as eventId, eventDate (when the event is taking place), and facilitiesUsed. Events are also linked to meeting rooms (where the event is taking place) and hosts.
* **Hosts:** the person who hosts event.
* **Slots**: There are 7 slots in total, which are breakfast, morning, lunch, afternoon, evening, supper, and night. Events held during breakfast, lunch, and supper have a 50% off discount.
* **Guest Attendance**: This is the guest\_evententity connects guests to specific events, recording attendance details. In other words, the relationship between guest and event is many-to-many.

**Assumptions** over Reservations and Billing:

1. The slots with different discount rate are assigned to events.
2. The guest doesn’t necessarily live in the hotel while they are attending the event. So, they might be in the event at a time when they might not have a room\_guest record.
3. One event matches one host, and a host can host more than one event.

***-Guest Interaction***

* **Card Access**: Guests use the card\_room entity, which tracks PIN-based access to rooms. This ensures security while enabling tracking of room availability.
* **Guest Tracking**: Through their cards, guests can optionally interact with the system, which records their room access and event participation. This data is used to populate the gues\_room table by recording room entry and exit times and the guest-event table by tracking attendance at events.

**Assumptions** over Staff and Guest Interaction:

1. The card PIN is unique for each card all the time.
2. Card Pin is independent to the room assigned to it.

**Website:**

**1. User Interface (UI) Overview**

The website was designed by use to give a clean and structured designed to showcase the hotel management system efficiently:

**Navigation Bar: Located at the top, includes links to:**

**Home:** home page.

**Room Queries:** Addresses questions related to room usage, such as revenue generated by room types and the average length of stay based on room furniture.

**Customer Queries:** Addresses questions related to customers, like identifying the most loyal customers and determining the most popular months for reservations.

**Other Queries:** Addresses questions related to services and events, such as revenue contributions from specific events, services used during months, and comparisons between different offerings to identify trends and optimize resource allocation.

**Update tab:** adding new guests to the system

In addition, there is a dashboard having the Icons linking directly to core features:

“Room Queries”, “Customer Queries”, “Other Queries”

**2. Website Features:**

* **Room Queries:** Addresses questions related to room usage, revenue, and trends:

- **Monthly Meeting Room Revenue in 2023**

* **Description**: Displays the total revenue generated from meeting rooms, broken down by month.
* **Benefit**: Helps management analyze seasonal demand for meeting rooms, optimize pricing strategies, and plan promotions during peak months.

- **Most Popular Room Type**

* **Description**: Identifies which room type (e.g., suites, smoking rooms, etc.) is booked most frequently.
* **Benefit**: Enables management to refine room pricing, allocate more resources to high-demand room types, and adjust marketing efforts to align with customer preferences.

- **Revenue by Smoking vs. Non-Smoking Rooms**

* **Description**: Compares revenue generated by smoking and non-smoking rooms.
* **Benefit**: Helps management assess guest preferences, inform room allocation decisions, and respond to regulatory or customer trends regarding smoking policies.

- **Peak Check-In Times by Time Slot**

* **Description**: Displays check-in times grouped into four daily time slots, showing when guests typically arrive.
* **Benefit**: Helps optimize staffing during peak check-in times, improve guest satisfaction with quicker check-ins, and streamline front desk operations.
* **Customer Queries:** Addresses questions related to customer behavior, loyalty, and trends

**- Reservation Counts Per Month in 2023**

* **Description**: Shows monthly trends in reservation counts for the year 2023.
* **Benefit**: Allows management to identify peak and low-occupancy months, enabling better resource planning, staffing, and targeted marketing campaigns.

**-Total Reservations Per Customer (Top 5)**

* **Description**: Identifies the top 5 customers based on the total number of reservations made.
* **Benefit**: Helps management recognize loyal customers, target them with personalized offers, and build long-term relationships through loyalty programs.

**-Payment Methods by Customers**

* **Description**: Displays the most frequently used payment methods (e.g., credit card, debit card, cash).
* **Benefit**: Streamlines payment operations, ensures preferred methods are prioritized, and enhances customer satisfaction by offering flexible payment options.
* **Other Queries:** Addresses questions related to services, events, and overall performance

**- Comparison of Total Revenue Between Room Types**

* **Description**: Compares revenue generated by different room types, such as sleeping rooms and meeting rooms.
* **Benefit**: Helps management evaluate which room categories are most profitable, guiding future investments and pricing strategies.

**-Revenue Contribution by Each Event**

* **Description**: Displays revenue generated by individual events hosted at the hotel.
* **Benefit**: Enables management to assess the profitability of events, identify high-value clients, and improve marketing efforts for similar events in the future.

**-Revenue from Services in February**

* **Description**: Highlights revenue earned from services (e.g., food & drinks, extra cleaning) during February.
* **Benefit**: Allows management to analyze service usage during specific months, optimize offerings, and develop seasonal promotions to maximize off-peak earnings.

**-Average Length of Stay by Room Type**

* **Description**: Shows the average duration of guest stays based on room furniture descriptions.
* **Benefit**: Helps forecast room availability, refine pricing strategies for long-term and short-term stays, and align room offerings with guest preferences.

**3. Code Structure**

The Code we submitted contains the following:

1. **Static Folder:** Contains static assets:
2. **CSS:** main.css manages the styling, ensuring a consistent look and feel.
3. **Images:** For visual content.

**-Templates Folder:**

base.html: Base template for consistent layout.

index.html: Landing page showcasing the system's features.

room.html: Displays Room Queries.

customer.html: Handles Customer Queries.

other.html: Displays Other Queries (service/events).

edit.html: Provides functionality to edit guest information.

error.html: For error handling.

**-Core Python Files:**

app.py: Likely serves as the main entry point for the Flask application, handling routes and logic.

queries.py: Contains SQL queries to fetch data for various functionalities.

**Anomaly**

**I. Noticeable Anomaly/Problems during the thinking process:**

-**Website Layout Issues**:

* We encountered issues with the initial website layout but resolved them by refining the CSS to improve structure and styling.

**-Foreign Key Relationship Between Meeting Room and Sleeping Room**:

* There was a problem with connecting the **foreign key** to both the meeting\_room and sleeping\_room primary keys simultaneously.
* **Solution**: We created a new combined\_room entity to integrate all rooms and then linked the foreign key directly to the combined\_roomId.

**-Error Page Integration**:

* We faced challenges when redirecting to the **error page** after uploading data from the database. Additionally, rendering the website and queries required adjustments based on the table attributes to ensure the correct display of data.

**-Classification of Meeting Room and Sleeping Room**:

* There was a debate on whether to classify meeting room as a special case of sleeping room or vice versa. In the end, we address it, by bringing in a new assumption that there won’t be a middle state.

**-Room Rental Fee Determination**:

* We were uncertain if the basic rental fee for rooms should be determined solely by their **capacity** or if other factors should be included. In the end, we clear out the confusion by generalize it simply as room rate

**-Building, Wing, and Floor Relationships**:

* The relationships between the **building**, **wing**, and **floor** entities were initially unclear, leading to confusion in their hierarchical structure.

**-Movable Wall Functionality**:

* We questioned whether the presence of a **movable wall** would alter the original functionality of the room (e.g., separating it into smaller rooms or not).

**II. Conclusion and Further Implementation:**

In conclusion, the hotel management system addresses key operational queries through its modular design and structured database. The system offers valuable insights into room usage, customer behavior, and service/event performance, enabling data-driven decision-making to optimize operations and enhance overall guest experiences.

However, we do recognize that there is much room for improvements lies in the current product. They are but not limited to:

- **Data Visualization:** including graphs in addition to the existing data, further improving clarity and management decision-making.

- **Advanced Filtering Options:** including filtering features for users to view queries by custom date ranges, room types, and service categories for more flexible data analysis.   
- **Automated report generation:** While designing the website, we considered implementing a feature that allows users to generate an overview report of the hotel with a single click; however, implementing it exceeded our current skill range.

All in all, this project has been a valuable learning experience for use all, providing us with insights into database design, query implementation, and website development. Moving forward, we will carry the skills and knowledge gained from this project and apply them to future database systems