PHASE III: HOTEL MANAGEMENT SYSTEM

LOGICAL MODEL DESIGN

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Course: Database Development with PL/SQL (INSY 8311)

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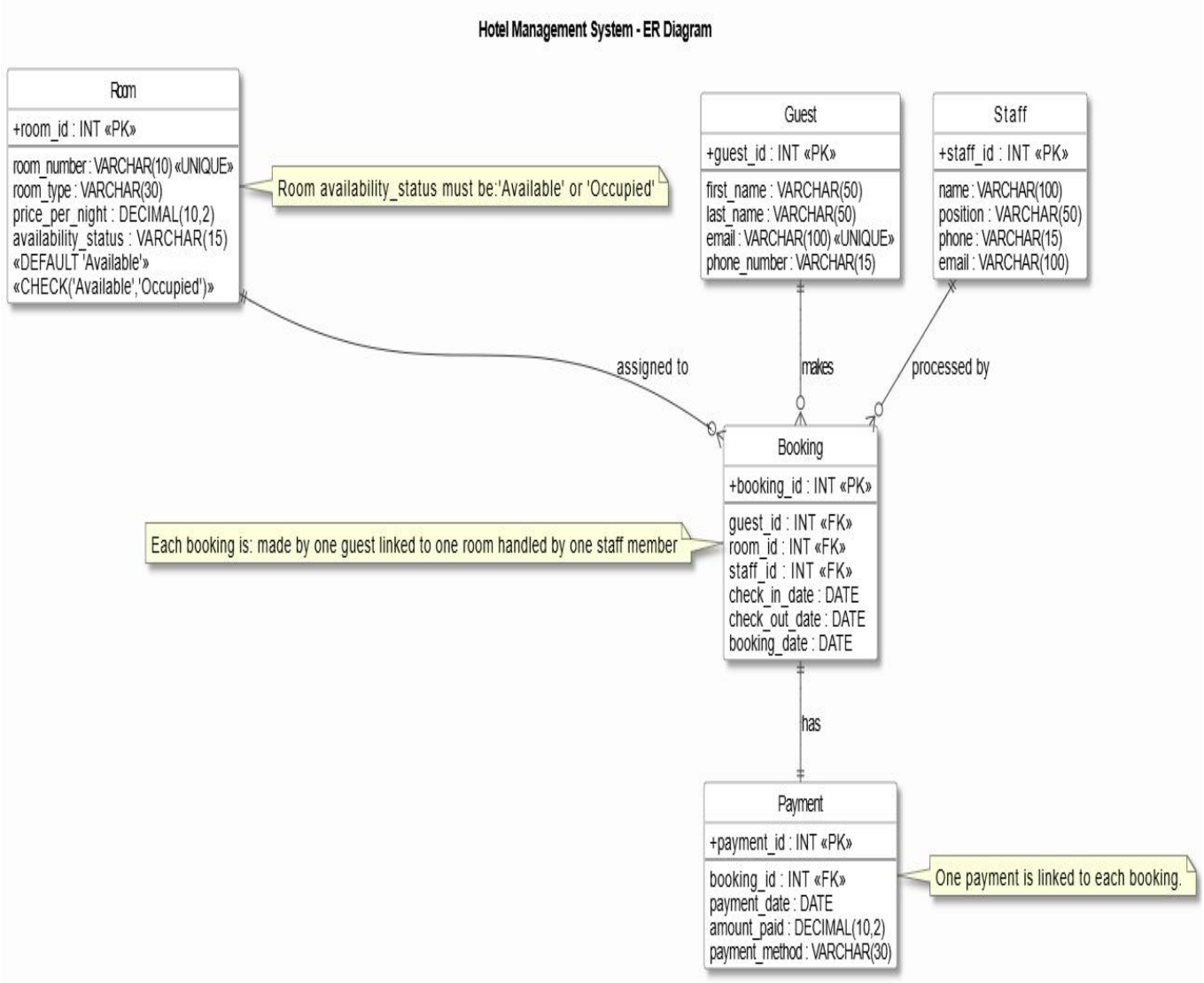

1. Introduction

This document shows a clear and simple design for a Hotel Management System database. The design is based on the **ER diagram**. This design is also the starting point for building a strong database to help manage hotel operations.

2. Project Overview

The Hotel Management System aims to streamline hotel operations by efficiently managing rooms, guests, staff, bookings, and payments. The system will enable hotel staff to track room availability, process bookings, manage guest information, and handle payments through a centralized database.

3. Entity Relationship Analysis

3.1 Core Entities

The logical model consists of five primary entities:

1. **Room**: Represents the hotel's accommodation units.
2. **Guest**: Contains information about hotel patrons.
3. **Staff**: Stores details about hotel employees.
4. **Booking**: Manages reservation information.
5. **Payment**: Tracks financial transactions related to bookings.

3.2 Relationships

The relationships between entities are defined as follows:

Room to Booking: One-to-many relationship

- One room can have multiple bookings over time
- Each booking is associated with exactly one room

Guest to Booking: One-to-many relationship

- One guest can make multiple bookings
- Each booking is associated with exactly one guest

Staff to Booking: One-to-many relationship

- One staff member can process multiple bookings
- Each booking is handled by exactly one staff member

Booking to Payment: One-to-one relationship

- Each booking has exactly one payment record
- Each payment is associated with exactly one booking

4. Detailed Entity Definitions

4.1 Room Entity

Attribute	Data Type	Constraints	Description
room_id	INT	PRIMARY KEY	Unique identifier for each room
room_number	VARCHAR2(10)	UNIQUE	Room number displayed to guests and staff
room_type	VARCHAR2(30)	NOT NULL	Category of room (e.g., Standard, Deluxe, Suite)
price_per_night	DECIMAL2(10,2)	NOT NULL	Cost per night for the

			room
availability_status	VARCHAR2(15)	DEFAULT 'Available', CHECK('Available','Occupied')	Current status of the room

Business Rules:

- Room numbers must be unique within the hotel
- Room availability must be either 'Available' or 'Occupied'
- Default status for new rooms is 'Available'

4.2 Guest Entity

Attribute	Data Type	Constraints	Description
guest_id	INT	PRIMARY KEY	Unique identifier for each guest
first_name	VARCHAR(50)	NOT NULL	Guest's first name
last_name	VARCHAR(50)	NOT NULL	Guest's last name
email	VARCHAR(100)	UNIQUE	Guest's email address for correspondence

Business Rules:

- Each guest must have a unique email address

- Guest contact information (email or phone) must be provided

4.3 Staff Entity

Attribute	Data Type	Constraints	Description
staff_id	INT	PRIMARY KEY	Unique identifier for each staff member
name	VARCHAR(100)	NOT NULL	Staff member's full name
position	VARCHAR(50)	NOT NULL	Job title or role within the hotel
phone	VARCHAR(15)		Staff contact number
email	VARCHAR(100)		Staff email address

Business Rules:

- Each staff member must have a defined position
- Contact information must be provided for communication purposes

4.4 Booking Entity

Attribute	Data Type	Constraints	Description
booking_id	INT	PRIMARY KEY	Unique identifier for each booking
guest_id	INT	FOREIGN KEY references Guest(guest_id)	Links to the guest making the booking
room_id	INT	FOREIGN KEY references Room(room_id)	Links to the room being booked
staff_id	INT	FOREIGN KEY references Staff(staff_id)	Links to staff member processing the booking
check_in_date	DATE	NOT NULL	Scheduled arrival date
check_out_date	DATE	NOT NULL	Scheduled departure date
booking_date	DATE	NOT NULL	Date when booking was created

Business Rules:

- Check-out date must be after check-in date
- Each booking is associated with exactly one guest, one room, and one staff member
- Booking date should be the current date when the booking is created

4.5 Payment Entity

Attribute	Data Type	Constraints	Constraints
payment_id	INT	PRIMARY KEY	PRIMARY KEY

booking_id	INT	FOREIGN KEY references Booking(booking_id), UNIQUE	FOREIGN KEY references Booking(booking_id), UNIQUE
payment_date	DATE	NOT NULL	NOT NULL
amount_paid	DECIMAL(10,2)	NOT NULL, CHECK(amount_paid > 0)	NOT NULL, CHECK(amount_paid > 0)
payment_method	VARCHAR(30)	NOT NULL	NOT NULL

Business Rules:

- Each payment is linked to exactly one booking
- Payment amount must be positive
- Payment method must be specified

5. Normalization Analysis

The logical model adheres to the principles of normalization through the Third Normal Form (3NF):

5.1 First Normal Form (1NF)

- All entities have a primary key
- All attributes contain atomic values
- No repeating groups or arrays

5.2 Second Normal Form (2NF)

- All entities satisfy 1NF
- All non-key attributes are fully functionally dependent on the primary key

5.3 Third Normal Form (3NF)

- All entities satisfy 2NF
- No transitive dependencies exist (non-key attributes depend only on the primary key)

6. Additional Constraints and Indexes

6.1 Check Constraints

Room Entity:

- CHECK (availability_status IN ('Available', 'Occupied'))

Booking Entity:

- CHECK (check_out_date > check_in_date)

Payment Entity:

- CHECK (amount_paid > 0)

6.2 Indexes

Primary Key Indexes:

- Automatically created on room_id, guest_id, staff_id, booking_id, and payment_id

Foreign Key Indexes:

- Create indexes on guest_id, room_id, and staff_id in the Booking table
- Create index on booking_id in the Payment table

Performance Indexes:

- Create index on room_number for faster room lookups
- Create index on email in the Guest table for faster guest lookups
- Create composite index on check_in_date and check_out_date in the Booking table for efficient date range queries

7. Data Integrity Rules

7.1 Referential Integrity

- Delete or update operations on parent tables (Room, Guest, Staff) should cascade or restrict based on business needs.
- Foreign key constraints ensure data consistency across tables

7.2 Entity Integrity

- Primary key constraints ensure uniqueness and non-null values for entity identifiers
- Unique constraints prevent duplicate records for business-critical attributes

7.3 Domain Integrity

- Data types enforce appropriate value formats
- CHECK constraints ensure valid values within defined domains
- DEFAULT values provide consistent initial states

8. Database Diagram

The logical model is visualized in the provided ER diagram, illustrating the entities, attributes, and relationships. The diagram shows:

- Primary keys indicated with the PK notation
- Foreign keys indicated with the FK notation
- Relationships between entities with appropriate cardinality notation
- Constraints and default values for key attributes

9. Implementation Considerations

9.1 Physical Database Design

When implementing this logical model in Oracle:

- Use appropriate Oracle data types (NUMBER for INT, VARCHAR2 for VARCHAR, etc.)
- Consider partitioning for large tables like Booking and Payment based on date ranges
- Implement appropriate tablespaces for optimal storage

9.2 Performance Optimization

- Use appropriate indexing strategies for frequently queried columns
- Consider materialized views for complex reporting queries
- Implement table partitioning for historical data

9.3 Security Considerations

- Implement role-based access control for different staff positions
- Encrypt sensitive guest information
- Establish audit trails for tracking changes to critical data

10. PL/SQL Implementation Plan

The following PL/SQL components will be developed based on this logical model:

Stored Procedures:

- Room management procedures (add, update, delete)
- Booking procedures (create, modify, cancel)
- Guest registration procedures
- Payment processing procedures

Functions:

- Calculate total stay cost based on room type and dates
- Check room availability for given dates
- Generate booking confirmation numbers
- Validate guest information

Triggers:

- Update room availability status when bookings are created or modified
- Enforce business rules for bookings and payments
- Implement auditing for sensitive operations
- Apply the weekday and holiday restrictions as specified in the requirements

Packages:

- Organize related procedures and functions into logical units
- Implement comprehensive error handling
- Create modular, reusable code components

11. Conclusion

This logical model design provides a comprehensive foundation for implementing the Hotel Management System database. The design ensures data integrity, optimizes performance, and supports all the business rules specified in the requirements. The model is normalized to the Third Normal Form and includes all necessary constraints and relationships to maintain a consistent and accurate representation of the hotel's operations.

The logical model is ready for implementation in Oracle using PL/SQL and will serve as the blueprint for the physical database design and development of the application layer components.