Northeastern University
DAMG6210 - Data Management and Database Design
Project Phase - 2 : Database Design Document

MEMBERS

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PROJECT TOPIC:

Stadium Management System

PROBLEM STATEMENT:

Managing structures that host more than 80,000 spectators goes beyond land acquisition, construction, and engineering disciplines like civil, mechanical, and electrical. Stadiums are mega-structures generating data at a scale that needs to be collected, processed, managed, and verified in real time. Thus there is a need for an automated information system - Stadium Management System which will help integrate data across multiple sources like match tickets, stadium seats, price catalog, payments, discounts, etc. Moreover, there is a need to create a versatile system that can model and replicate any stadium structure with the ability to support pricing/discounting customizations and easy data audits.

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OBJECTIVES:

1. To customize seating arrangements, pricing strategies, offers and discounts, and stadium entry points as required by the stadium management team.
2. To manage matches across multiple leagues and multi-channel ticketing like online, in-person, etc.
3. To handle multiple ticket bookings via a single user and tracking corresponding payments.
4. To provide flexibility for users to cancel and refund tickets which are governed by the stadium's refund policies.
5. To allow real-time ticket verification for authorized entry to secure the stadium from unauthorized personnel.
6. To help the stadium management get insights into revenue generation, match-wise attendance, and many more activities.

PROPOSED SOLUTION:

1. The proposed solution brings together stakeholders like customers, stadium marketing, operations, finance, security, and management teams while managing data at a scale in real-time.
2. It allows the stadium management teams to model and customize the solution that best represents the stadium's structural elements, like sections, gates, rows, and seats. Any new seat additions concerning stadium expansion can be gracefully factored in and synced with the ticket booking module for upcoming matches.
3. The seats can be clubbed together as per ticket segments like general, gold, silver, VIP, and many more.
4. The solution also allows the stadium's marketing teams to customize a pricing strategy for ticket segments per match which can change over time.
5. Marketing teams have the ability to add discount coupons to attract customers that are verified automatically and applied as per the stadium's policies.
6. It also helps the management team manage and maintain match timetables across several leagues anticipated to take place in their stadium.
7. The solution maintains data relating to the stadium's customers. This data is used later while ticketing, payments, etc. While it does that, authentication and authorization of customers happen outside the system generally by an identity management service.
8. Customers have the flexibility to book single or multiple tickets for any upcoming matches. They can also benefit from the discount coupons set into the system. They also have the ability to cancel seats and ask for a refund in a particular timeline.
9. The stadium's finance team can track payments relating to ticket bookings and refund cases.
10. The stadium's operation team and security team can verify tickets in real time during a match and get an idea about stadium footfall.

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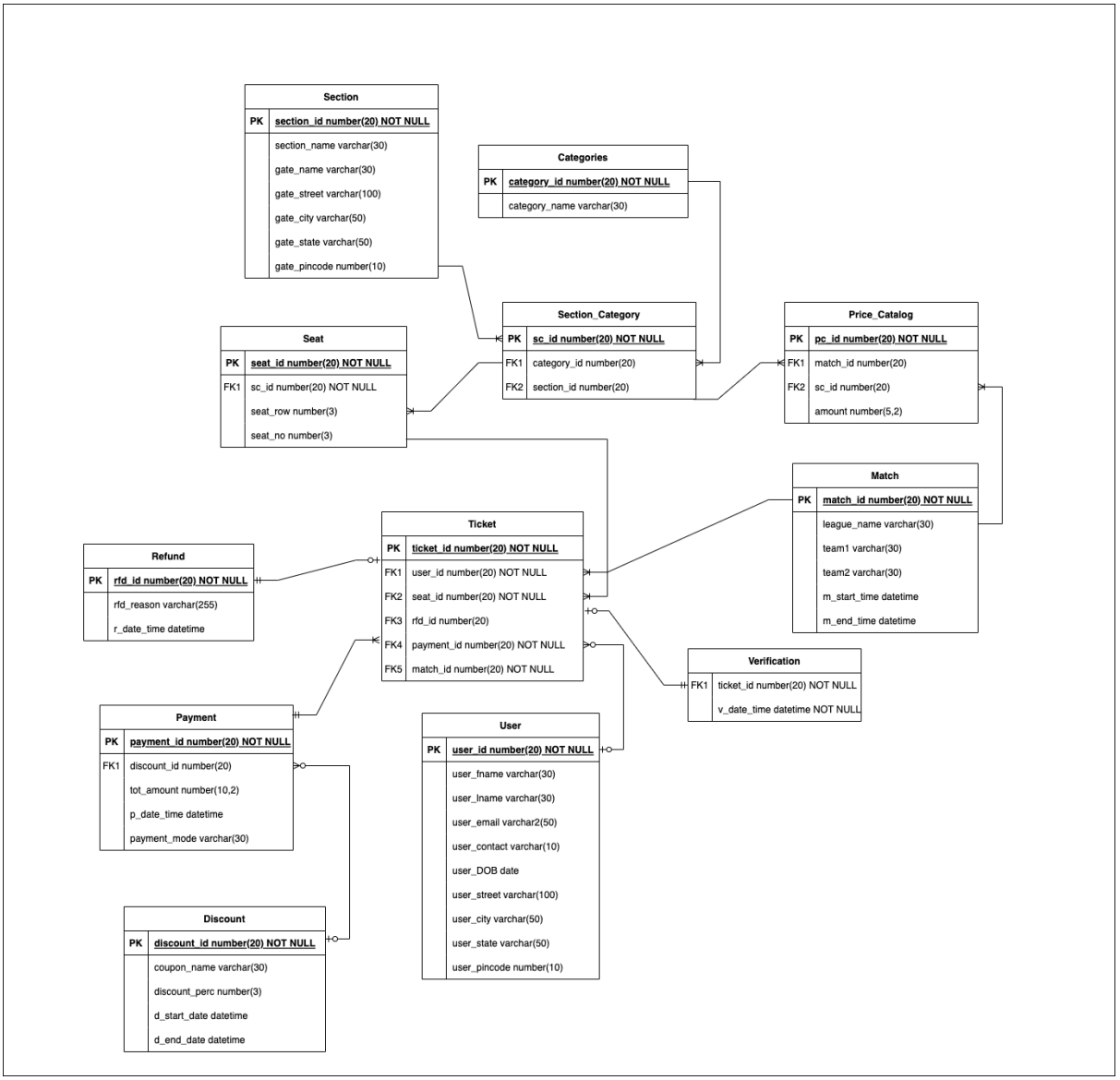
E-R DIAGRAM:



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ENTITIES & ATTRIBUTES

Entity 1: Refund

ATTRIBUTES	DATATYPE	CONSTRAINT
rfd_id	number(20)	NOT NULL, Primary key
rfd_reason	varchar(255)	
r_date_time	datetime	

Entity 2: Match

ATTRIBUTES	DATATYPE	CONSTRAINT
match_id	number(20)	NOT NULL, Primary key
league_name	varchar(30)	
team1	varchar(30)	
team2	varchar(30)	
m_start_time	datetime	
m_end_time	datetime	

Entity 3: Price_Catalog

ATTRIBUTES	DATATYPE	CONSTRAINT
match_id	number(20)	Foreign key
sc_id	number(20)	Foreign key
pc_id	number(20)	Primary key
amount	number(5,2)	

Entity 4: Payment

ATTRIBUTES	DATATYPE	CONSTRAINT
payment_id	number(20)	Primary Key
discount_id	number(20)	Foreign key
tot_amount	number(10,2)	
p_date_time	datetime	
payment_mode	varchar(30)	

Entity 5: Ticket

ATTRIBUTES	DATATYPE	CONSTRAINT
ticket_id	number(20)	Primary key, NOT NULL
user_id	number(20)	Foreign key, NOT NULL
match_id	number(20)	Foreign key, NOT NULL
seat_id	number(20)	Foreign key, NOT NULL
rfd_id	number(20)	Foreign key
payment_id	number(20)	Foreign key, NOT NULL

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Entity 6:User

ATTRIBUTES	DATATYPE	CONSTRAINT
user_id	number(20)	Primary Key
user_fname	varchar(30)	
user_email	varchar2(50)	
user_contact	varchar(10)	
user_dob	date	
user_lname	varchar(30)	
user_street	varchar(100)	
user_city	varchar(50)	
user_state	varchar(50)	
user_pincode	number(10)	

Entity 7: Discount

ATTRIBUTES	DATATYPE	CONSTRAINT
discount_id	number(20)	Primary key
coupon_name	varchar(30)	
discount_perc	number(3)	
d_start_time	datetime	
d_end_time	datetime	

Entity 8: Seat

ATTRIBUTES	DATATYPE	CONSTRAINT
Seat_id	number(20)	Primary key, NOT NULL
sc_id	number(20)	Foreign key, NOT NULL

seat_row	number(3)	
seat_no	number(3)	

Entity 9: Verification

ATTRIBUTES	DATATYPE	CONSTRAINT
ticket_id	number(20)	NOT NULL, Foreign key
verify_date	datetime	NOT NULL

Entity 10: Section

ATTRIBUTES	DATATYPE	CONSTRAINT
section_name	varchar(30)	
section_id	number(20)	Primary Key
gate_name	varchar(30)	
gate_street	varchar(100)	
gate_city	varchar(50)	
gate_state	varchar(50)	
gate_pincode	number(10)	

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BUSINESS RULES

1. Our Stadium Management System currently only manages 1 stadium.
2. A section can have only 1 gate.
3. Every category name is unique.
4. A seat should belong to only 1 category and only 1 section.
5. A section-category for a match can have only 1 price which cannot be updated.
6. A match can be played between only 2 teams.
7. 2 teams playing a match must be different.
8. A match can belong to only 1 league.
9. It is assumed that the customers are already verified and logged in.
10. A discount should have start time and end time.
11. A discount can be applied only for a certain amount of time.
12. A discount can only be in percentage between 0% - 100%.
13. A discount is generic and independent of any seat or any match.
14. Customers can book multiple tickets.
15. A customer can only make one payment at a time.
16. A ticket can have only one customer.
17. A payment can have only one customer.
18. A payment can have multiple tickets.
19. A refund can belong to only 1 ticket.
20. A seat which is refunded can be booked again.
21. A payment does not necessarily have a discount.
22. There are 2 modes of payment -
    a. Electronic
    b. Cash
23. Verification of tickets(entry to stadium) will happen 3 hours prior to the match start datetime.
24. There must be more than 5 hours interval between 2 matches.

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VIEWS

1. V_Show_Seating_Structure - STADIUM_MANAGER wants to get an idea about the stadium
2. V_Show_Seats_Status - STADIUM_MANAGER wants to see the seat booking status over matches
3. V_Show_Upcoming_Matches - For CUSTOMERS to see upcoming matches
4. V_User_Tickets - For CUSTOMERS to review past ticket bookings details
5. V_Available_Seats - For CUSTOMERS to review available seats
6. V_Tickets_With_Discounts - To understand how a discount scheme affected ticket bookings
7. V_Show_Refunded_Tickets - To understand user wise refund details
8. V_Match_Wise_Attendance - To understand how many people attended match
9. V_Yearly_Monthly_Sales - To understand year and month wise sales
10. V_League_Team_Sales - To understand league and team wise sales

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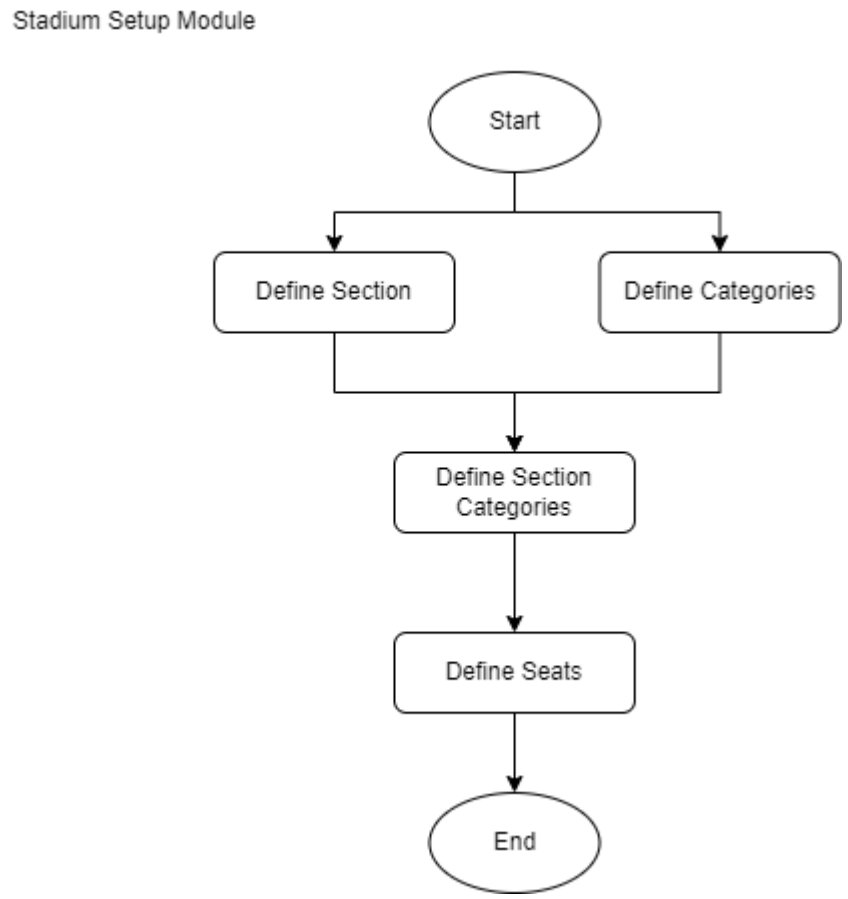
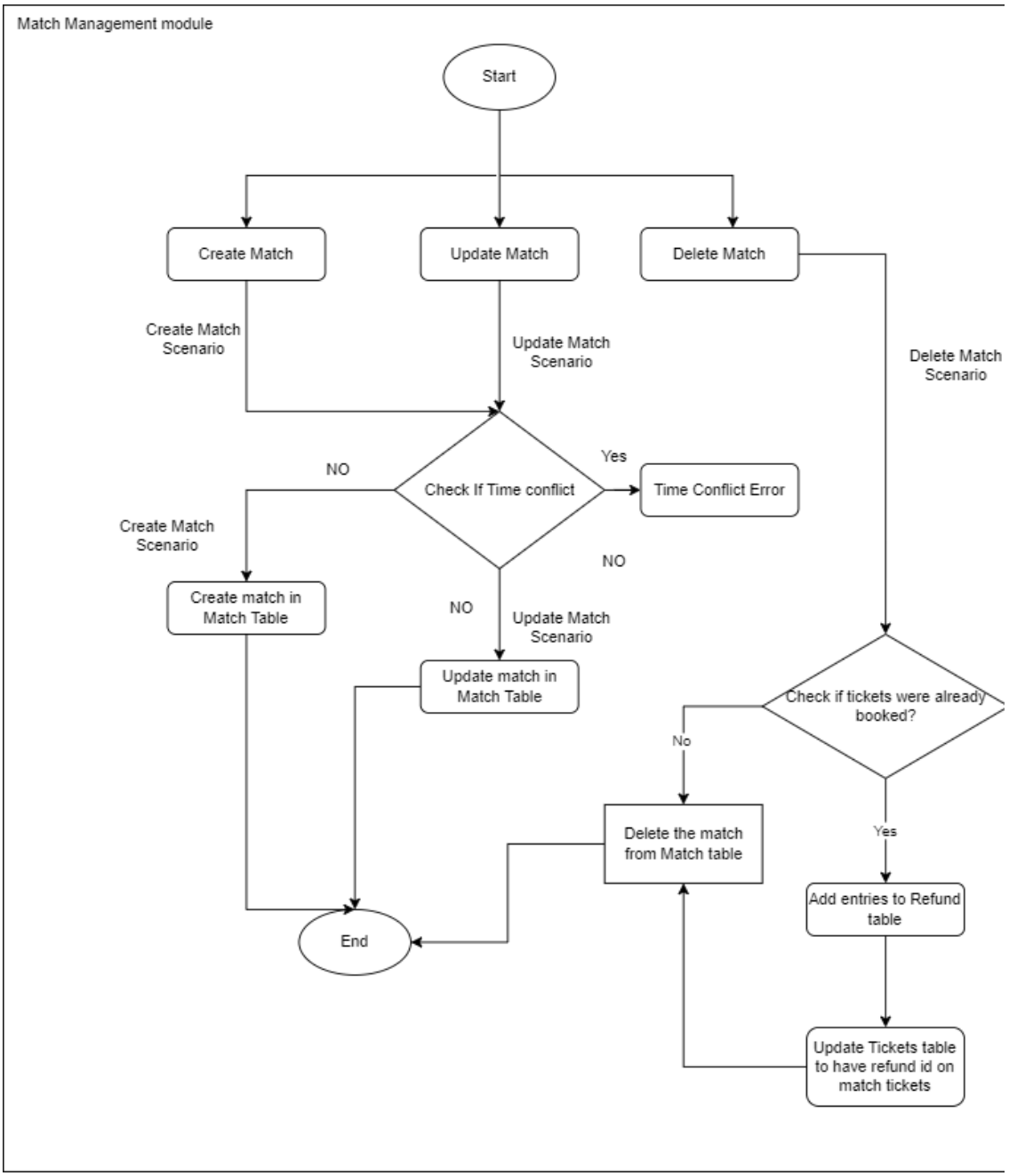
DATA FLOW DIAGRAMS

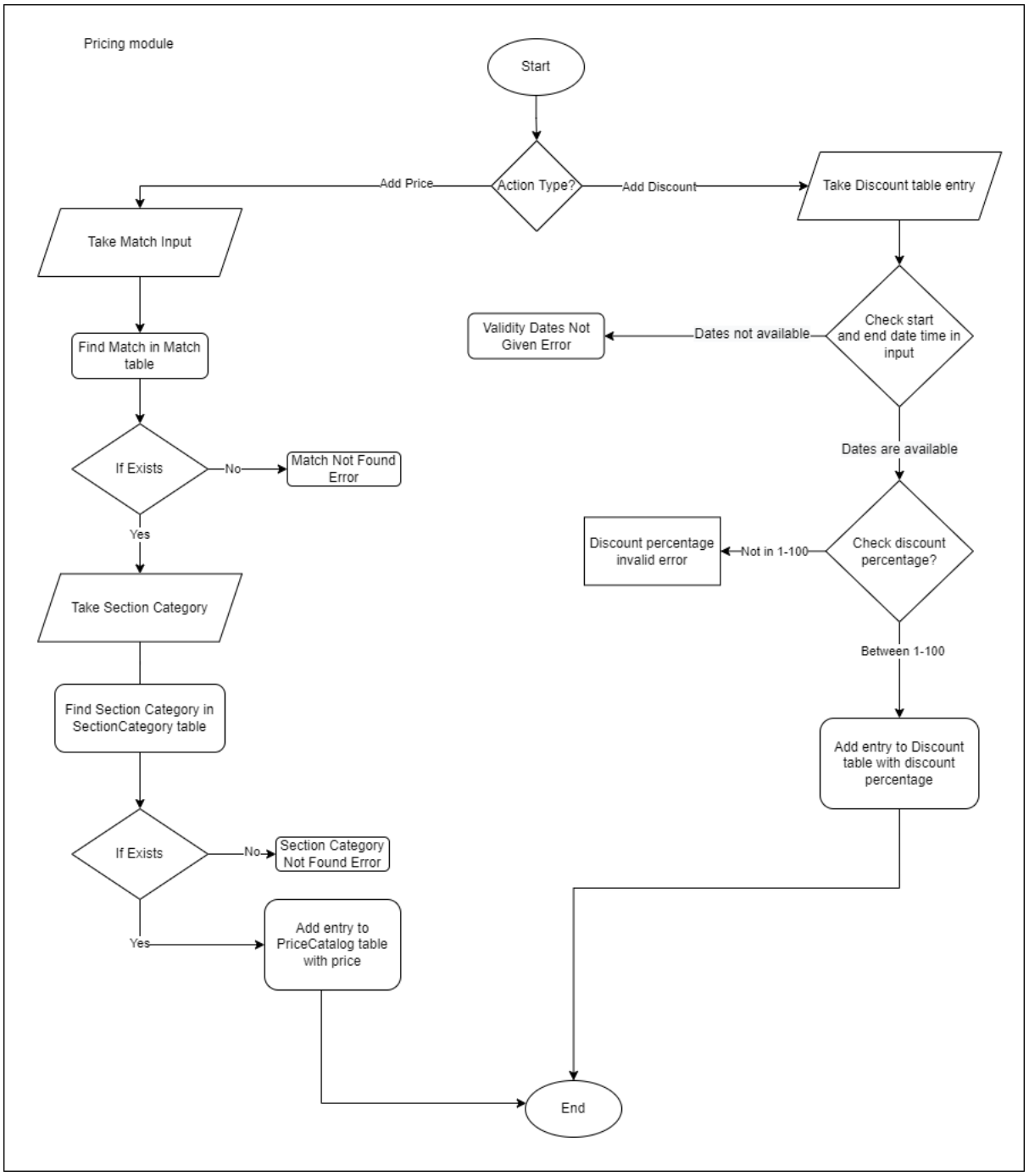
1. Stadium Setup Module



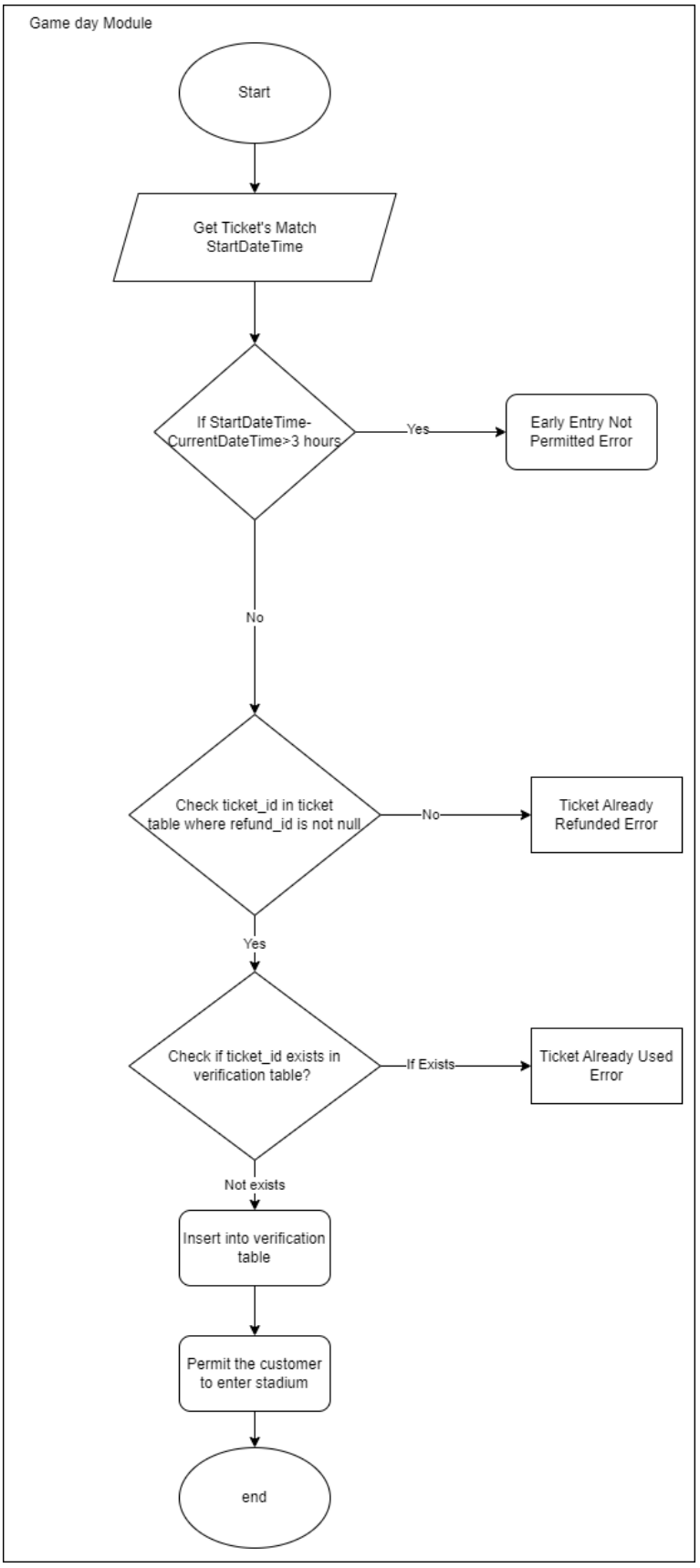
2. Match Management Module



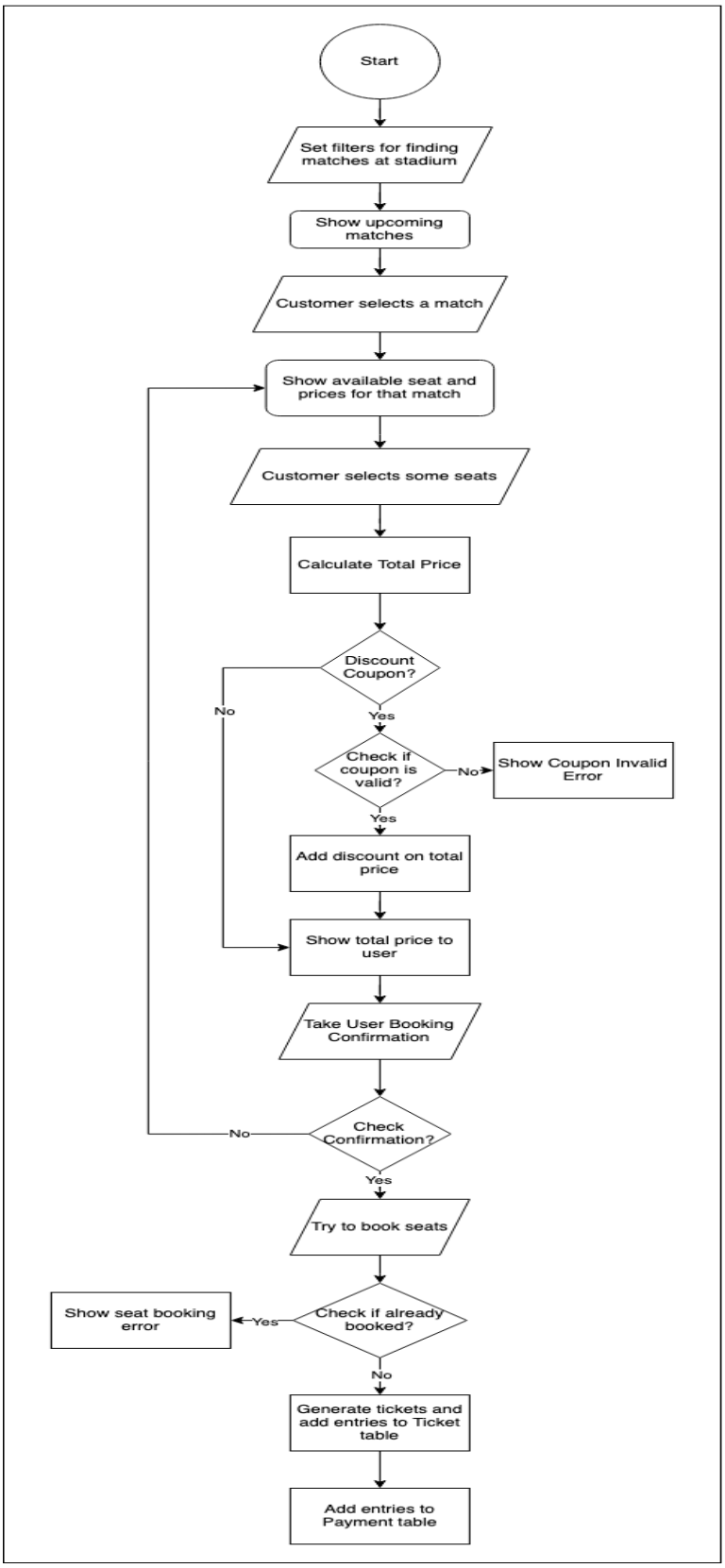
3. Pricing Module



4. GameDay Module



5. Ticket Management Module



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SECURITY ROLES (USER LEVEL ACCESS / PERMISSIONS)

1. ADMIN:
    a. Has full access to all the entities in the database.

2. STADIUM_MANAGER:
    a. Has read/write access to the Section table.
    b. Has read/write access to the Category table.
    c. Has read/write access to the Section_Category table.
    d. Has read/write access to the Seat table.
    e. Has read/write/update access to the Match table.
    f. Has read access to the Ticket table.

3. FINANCE_MANAGER:
    a. Has read access to the Section table.
    b. Has read access to the Category table.
    c. Has read access to the Section_Category table.
    d. Has read access to the Match table.
    e. Has read/write access to the Price_Catalog table.
    f. Has read/write access to the Discount table.
    g. Has read access to the Payment table.
    h. Has read access to the Ticket table.
    i. Has read access to the Refund table.

4. CUSTOMER:
    a. Has read/write/update access to the User table.
    b. Has indirect read access to seat, matches, price, etc. controlled via views.
    c. Has indirect write access to book tickets controlled via functions, and stored procedures.

5. STADIUM_SECURITY:
    a. Has read/write access to the Verification table.
    b. Has read access to the Ticket table.