Project 4: Implementing a Database

Database Planning and Requirement Analysis
Event Management System: OccasionOrganizer

By

Group ID: 15

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To
Asst. Prof. Dr. Charnyote Pluempitiwiriyawej

A Report Submitted in Partial Fulfillment of
the Requirements for

ITCS413 Database Design

Faculty of Information and Communication Technology
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The relational schemas from phase 3 and the corresponding ER diagram

Relation Schema

- **Attributes** – which are bold and underlined are the Primary Keys
- *Attributes* – which are Italic are the Foreign Keys
- ***Attributes*** – which are bold, italic and underlined are both Primary Keys and Foreign Keys

- Attendee

attendee_id	name	email	username	password

- Ticket

ticket_id	serial_number	gate	zone	seat	price	date	start_time	end_time	*attendee_id*	*concert_id*

- Concert

concert_id	concert_name	date	start_time	end_time	*sponsor_id*	sponsor_name	sponsor_detail	amount	*location_id*	*equipment_id*	*artist_id*

- Location

location_id	location_name	location_address

- Admin

admin_id	first_name	last_name	username	password	*concert_id*

- Artist

artist_id	full_name	genre	contact_details	*location_id*

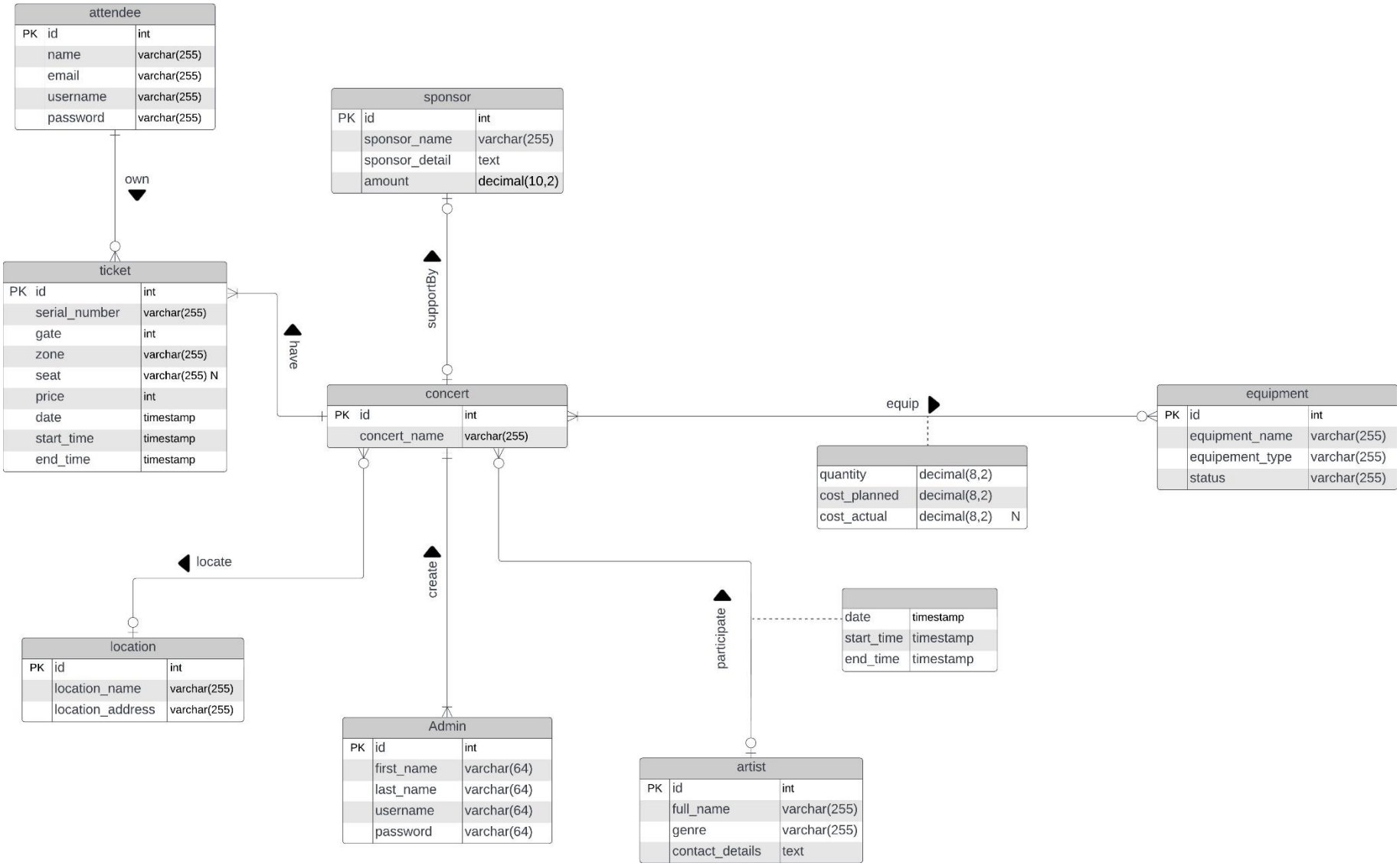
- Equipment

equipment_id	equipment _name	equipment_type	status

- Equip

equipment_id	*concert_id*	*location_id*	quantity	cost_planned	cost_actual

ER diagram


attendee
PK id int
name varchar(255)
email varchar(255)
username varchar(255)
password varchar(255)
own
sponsor
PK id int
sponsor_name varchar(255)
sponsor_detail text
amount decimal(10,2)
supportBy
ticket
PK id int
serial_number varchar(255)
gate int
zone varchar(255)
seat varchar(255) N
price int
date timestamp
start_time timestamp
end_time timestamp
have
concert
PK id int
concert_name varchar(255)
equip
quantity decimal(8,2)
cost_planned decimal(8,2)
cost_actual decimal(8,2) N
equipment
PK id int
equipment_name varchar(255)
equipement_type varchar(255)
status varchar(255)
locate
location
PK id int
location_name varchar(255)
location_address varchar(255)
create
Admin
PK id int
first_name varchar(64)
last_name varchar(64)
username varchar(64)
password varchar(64)
participate
date timestamp
start_time timestamp
end_time timestamp
artist
PK id int
full_name varchar(255)
genre varchar(255)
contact_details text

The normalized relational database schema and corresponding ER diagram

Normalized relation schema

- Unnormalized Form

AID	Name	Email	Username	Password	TID	Serial Number	Gate	Zone	Seat	Price	Date	Start Time	End Time	CID	Concert Name	NID	Full Name	Genre	Contact Details	LID	Location Name	Location Address	SID	Sponsor	Sponsor detail	Amount	MID	First Name	Last Name	Username	Password
1000001	Subin Hamphadungkit	subin.hamphadungkit@example.com	shamphadungkit	TXaKQDmXFI	300300000	IU-0600001	Gate 1	A3	A44	6,500 THB	29 June 2024	5:00 PM	9:00 PM	901	2024 IU H.E.R. WORLD TOUR CONCERT IN BANGKOK	120001	IU	K-pop	EDAM Entertainment	104	Impact Challenger Hall	IMPACT Challenger Building Popular 1 Rd, Pak Kret District, Nonthaburi 11120	5105	iMe	Technology sponsor	1,500,000 THB	64001	Nattanicha	Sinsawet	nattanicha.sin	yuvoyon!0k9.
					300400000	DRM-6732899	Gate 4	R	L13	2,900 THB	12 March 2023	4:00 PM	6:00 PM	905	NCT DREAM TOUR 'THE DREAM SHOW2 : In A DREAM' in BANGKOK	120005	NCT Dream	K-pop	SM Entertainment	101	Impact Arena, Muang Thong Thani	19 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5008	SM True	Joint venture partner	12,000,000 THB	64002	Chommakorn	Sontesadisai	chommakorn.son	789!4Evsr
1000002	Bawontat Chatchonbut	bawontat.chatchonbut@example.com	bchatchonbut	7cXzAIUO9X	300300001	IU-0600002	Gate 1	A3	A45	6,500 THB	29 June 2024	5:00 PM	9:00 PM	901	2024 IU H.E.R. WORLD TOUR CONCERT IN BANGKOK	120001	IU	K-pop	EDAM Entertainment	104	Impact Challenger Hall	IMPACT Challenger Building Popular 1 Rd, Pak Kret District, Nonthaburi 11120	5105	iMe	Technology sponsor	1,500,000 THB	64001	Nattanicha	Sinsawet	nattanicha.sin	yuvoyon!0k9.
					300400001	DRM-6732900	Gate 4	R	L14	2,900 THB	12 March 2023	4:00 PM	6:00 PM	905	NCT DREAM TOUR 'THE DREAM SHOW2 : In A DREAM' in BANGKOK	120005	NCT Dream	K-pop	SM Entertainment	101	Impact Arena, Muang Thong Thani	19 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5008	SM True	Joint venture partner	12,000,000 THB	64002	Chommakorn	Sontesadisai	chommakorn.son	789!4Evsr
1047656	Theeraphat Pattamasirikun	theeraphat.pattamasirikun@example.com	tpattamasirikun	vVT7ZCDtoH	300347655	SPE-7890002	Gate 1	AL	STANDING	5,500 THB	22 September 2023	7:00 PM	11:00 PM	903	789 SPECIAL STAGE THE TIME CAPSULE	120003	789TRAINEE	T-pop	SONRAY MUSIC	103	Thunder Dome, Muang Thong Thani	1 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5110	Nestlé Pure Life	Food and beverage partner	2,000,000 THB	64003	Ravikarn	Jarungjitvittawas	ravikarn.jar	CityMelody#1
					300395312	DRM-6728211	Gate 3	SK	H13	6,000 THB	12 March 2023	4:00 PM	6:00 PM	905	NCT DREAM TOUR 'THE DREAM SHOW2 : In A DREAM' in BANGKOK	120005	NCT Dream	K-pop	SM Entertainment	101	Impact Arena, Muang Thong Thani	19 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5008	SM True	Joint venture partner	12,000,000 THB	64002	Chommakorn	Sontesadisai	chommakorn.son	789!4Evsr

- 1NF (First Normal From)

AID	Name	Email	Username	Password	TID	Serial Number	Gate	Zone	Seat	Price	Date	Start Time	End Time	CID	Concert Name	NID	Full Name	Genre	Contact Details	LID	Location Name	Location Address	SID	Sponsor	Sponsor detail	Amount	MID	First Name	Last Name	Username	Password
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1000001	Subin Hamphadungkit	subin.hamphadungkit@example.com	shamphadungkit	TXaKQDmXFI	300400000	DRM-6732899	Gate 4	R	L13	2,900 THB	12 March 2023	4:00 PM	6:00 PM	905	NCT DREAM TOUR 'THE DREAM SHOW2 : In A DREAM' in BANGKOK	120005	NCT Dream	K-pop	SM Entertainment	101	Impact Arena, Muang Thong Thani	19 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5008	SM True	Joint venture partner	12,000,000 THB	64002	Chommakorn	Sontesadisai	chommakorn.son	789!4Evsr
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1000002	Bawontat Chatchonbut	bawontat.chatchonbut@example.com	bchatchonbut	7cXzAIUO9X	300400001	DRM-6732900	Gate 4	R	L14	2,900 THB	12 March 2023	4:00 PM	6:00 PM	905	NCT DREAM TOUR 'THE DREAM SHOW2 : In A DREAM' in BANGKOK	120005	NCT Dream	K-pop	SM Entertainment	101	Impact Arena, Muang Thong Thani	19 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5008	SM True	Joint venture partner	12,000,000 THB	64002	Chommakorn	Sontesadisai	chommakorn.son	789!4Evsr
1047656	Theeraphat Pattamasirikun	theeraphat.pattamasirikun@example.com	tpattamasirikun	vVT7ZCDtoH	300347655	SPE-7890002	Gate 1	AL	STANDING	5,500 THB	22 September 2023	7:00 PM	11:00 PM	903	789 SPECIAL STAGE THE TIME CAPSULE	120003	789TRAINEE	T-pop	SONRAY MUSIC	103	Thunder Dome, Muang Thong Thani	1 Mueang Thong Thani Rd, Pak Kret District, Nonthaburi Province 11120, Thailand	5110	Nestlé Pure Life	Food and beverage partner	2,000,000 THB	64003	Ravikarn	Jarungjitvittawas	ravikarn.jar	CityMelody#1
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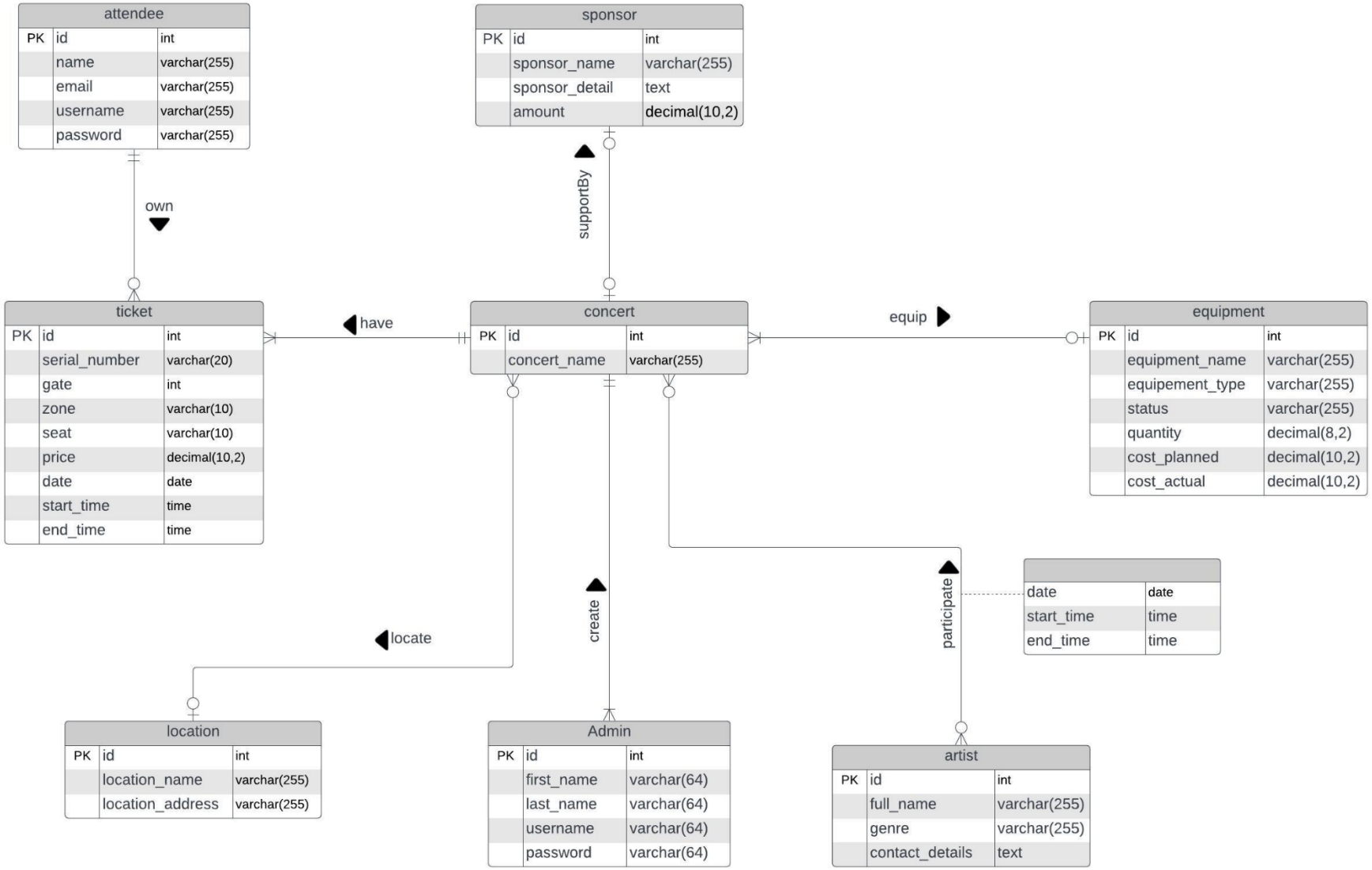
  - OccasionOrganizer (AID, Name, Email, Username, Password, TID, Serial Number, Gate, Zone, Seat, Price, Date, Start Time, End Time, CID, Concert Name, NID, Full Name, Genre, Contact Details, LID, Location Name, Location Address, SID, Sponsor, Sponsor detail, Amount, MID, First Name, Last Name, Username, Password)

- 2NF (Second normal form)
  - Attendee (**attendee_id**, name, email, username, password)
  - Ticket (**ticket_id**, serial_number, gate, zone, seat, price, date, start_time, end_time, *attendee_id*, *concert_id*)
  - Concert (**concert_id**, concert_name, date, start_time, end_time, sponsor_id, sponsor_name, sponsor_detail, amount, *location_id*, *equipment_id*, *artist_id*)
  - Location (**location_id**, location_name, location_address)
  - Admin (**admin_id**, first_name, last_name, username, password, *concert_id*)
  - Artist (**artist_id**, full_name, genre, contact_details, *location_id*)
  - Equipment (**equipment_id**, equipment _name, equipment_type, status, quantity, cost_planned, cost_actual)
  - Participate (*artist_id*, *concert_id*, date, start_time, end_time)

- 3NF (Third normal form)
    - Attendee:
        - attendee_id -> name, email, username, password
        - username -> attendee_id, name, email, password
        - email -> attendee_id, name, username, password
    - Ticket:
        - ticket_id -> serial_number, gate, zone, seat, price, date, start_time, end_time, attendee_id, concert_id
        - serial_number -> ticket_id, gate, zone, seat, price, date, start_time, end_time, attendee_id, concert_id
        - attendee_id, concert_id -> ticket_id, serial_number, gate, zone, seat, price, date, start_time, end_time
    - Concert:
        - concert_id -> concert_name, date, start_time, end_time, sponsor_id, sponsor_name, sponsor_detail, amount, location_id, equipment_id, artist_id
    - Location:
        - location_id -> location_name, location_address
    - Admin:
        - admin_id -> first_name, last_name, username, password, concert_id
        - username -> admin_id, first_name, last_name, password, concert_id
    - Artist:
        - artist_id -> full_name, genre, contact_details, location_id
    - Equipment:
        - equipment_id -> equipment_name, equipment_type, status
    - Equip:
        - equipment_id, concert_id -> quantity, cost_planned, cost_actual
    - Participate:
        - artist_id, concert_id -> date, start_time, end_time
    - Additional FDs:
        - location_id -> artist_id (assuming each artist is associated with a unique location)
        - concert_id -> admin_id (assuming each concert is managed by a single admin

ER diagram


attendee
PK id int
name varchar(255)
email varchar(255)
username varchar(255)
password varchar(255)
own
sponsor
PK id int
sponsor_name varchar(255)
sponsor_detail text
amount decimal(10,2)
supportBy
ticket
PK id int
serial_number varchar(20)
gate int
zone varchar(10)
seat varchar(10)
price decimal(10,2)
date date
start_time time
end_time time
have
concert
PK id int
concert_name varchar(255)
equip
equipment
PK id int
equipment_name varchar(255)
equipement_type varchar(255)
status varchar(255)
quantity decimal(8,2)
cost_planned decimal(10,2)
cost_actual decimal(10,2)
participate
date date
start_time time
end_time time
locate
create
location
PK id int
location_name varchar(255)
location_address varchar(255)
Admin
PK id int
first_name varchar(64)
last_name varchar(64)
username varchar(64)
password varchar(64)
artist
PK id int
full_name varchar(255)
genre varchar(255)
contact_details text

A discussion on the verification of your relational database schema

The ERD illustrates the following entities: Attendee, Ticket, Concert, Location, Admin, Artist, Equipment, Equip, and Participate.

The ERD seems to represent a well-structured schema for a concert ticket booking system. Reduce redundancy: The schema might benefit from normalization. For example, consider separating artist details into a dedicated Artist table linked to the Concert table through a foreign key. Additionally, ensure primary keys are unique identifiers (e.g., attendee_id instead of username). This helps minimize data inconsistencies.

Entity Breakdown:

- Attendee (**attendee_id**, name, email, username, password)
- Ticket (**ticket_id**, serial_number, gate, zone, seat, price, date, start_time, end_time, *attendee_id*, *concert_id*)
- Concert (**concert_id**, concert_name, date, start_time, end_time, sponsor_id, sponsor_name, sponsor_detail, amount, *location_id*, *equipment_id*, *artist_id*)
- Location (**location_id**, location_name, location_address)
- Admin (**admin_id**, first_name, last_name, username, password, *concert_id*)
- Artist (**artist_id**, full_name, genre, contact_details, *location_id*)
- Equipment (**equipment_id**, equipment _name, equipment_type, status, quantity, cost_planned, cost_actual)
- Participate (*artist_id*, *concert_id*, date, start_time, end_time)

Verification Points:

1. Data Types: But ensure each attribute has an appropriate data type (e.g., name: string, price: numeric).

2. Primary Keys:

    - Most tables seem to have them (e.g., attendee_id, ticket_id).
    - Consider attendee_id instead of username (might not be unique).
    - Concert table's concert_id referencing Admin table (assuming single admin per concert).
    - Location table's location_id.

3. Foreign Keys:

    - Ticket references attendee_id and concert_id for linking purchases.
    - Concert references location_id for venue information.
    - Consider if Artist table and Concert table need a foreign key relationship (e.g., Concert references artist_id for performing artist).

4. Normalization:

    - The schema might benefit from normalization to reduce redundancy.
    - Consider separating sponsor information into a dedicated table linked to Concert.
    - Artist information in Concert might be better suited in a separate Artist table with a foreign key in Concert.

5. Constraints:

    - Implement constraints to enforce data integrity (e.g., unique usernames, price ranges).
    - Consider a constraint to ensure enough equipment is available for a concert (based on Equipment).

3NF Violations:

The schema shows potential violations of 3NF:

- Attendee table: username as primary key might not be unique.
- Ticket table: attendee_id and concert_id could be separate foreign keys instead of part of the primary key.

Additional Notes:

- Participate table likely uses artist_id and concert_id as a composite primary key.
- Consider additional functional dependencies (FDs) like location being associated with a unique artist.

Overall:

While the schema captures the core entities and relationships, there's room for improvement with normalization and addressing potential 3NF violations. Implementing best practices and addressing these points will lead to a more efficient and reliable database.

A discussion on the implementation of your database including difficulty, challenges, solutions, limitation

Developing and implementing a database for our concert management project faced several challenges. From customer data management to ticket and marketing information, the database is designed to store information efficiently.

Difficulties and Challenges:

- One of the biggest challenges was handling the large data volumes required - hundreds of thousands of records in the Attendee and Ticket tables. Designing a database to perform well at this scale was difficult.
- Databases have to deal with a lot of data and quick access to information because there are so many customers and activities. The hardest part is making a database that can store and find information quickly.
- Putting together data from different sources, like customer data, ticket sales data, and marketing data from different places, like online ticketing sites. and channels for internet marketing Making sure that info is correct and consistent is hard.
- Starting from the relational model developed in phase 4, verifying that the schema is properly normalized (3NF) required careful analysis of functional dependencies. Some denormalization may be required for performance reasons.
- SQL errors often come with vague or overly general messages, making it difficult to pinpoint the actual cause of the issue.
- Errors stemming from improper database design, such as using incorrect data types or establishing inappropriate relationships between tables. Writing SQL commands with mistakes, such as syntax errors or the use of inappropriate functions.

Solutions:

- Use Python provides powerful libraries like Pandas and NumPy for data manipulation and cleaning. You can easily handle missing values, remove duplicates, and validate data types and formats.
- Employ detailed analysis and design of the database before development starts. Reviewing the data model by database experts can prevent many design-related issues.

- Carefully analyze the functional dependencies and normal forms to achieve a well-structured relational model. Strive for at least 3NF to minimize data redundancy and anomalies.
- Python's data wrangling capabilities make it easy to merge, filter, and aggregate data from multiple sources. You can join datasets based on common keys, compute derived fields, and pivot data into desired formats.
- Libraries like Pandas support reading data from various file formats (CSV, Excel, JSON, etc.) and connecting to databases using SQL. This simplifies the process of integrating data from different systems.

Limitation:

- Ensuring data consistency across multiple tables and enforcing integrity constraints can be difficult, especially with complex database designs. Transactions and ACID properties help maintain consistency, but they also add overhead.
- Data quality issues, such as missing or incorrect values, can propagate through the database if not caught and handled during data entry or ETL processes. Data validation and cleansing routines need to be robust.
- Even with careful design and the use of powerful libraries like Pandas and NumPy, handling the growing data volume as the business expands could become increasingly challenging. The database and its supporting infrastructure may require significant upgrades to maintain performance.
- While striving for a 3NF schema minimizes data redundancy, some level of denormalization may be necessary for performance optimization. Balancing these aspects without compromising data integrity or query efficiency can be difficult.
- Despite employing advanced tools and methodologies, the vagueness of SQL error messages and the complexity of debugging complex queries or data pipelines can slow down development and maintenance efforts.
- The need for detailed analysis and design, careful normalization, and advanced data manipulation skills means that maintaining and updating the database system requires a high level of technical expertise. This dependence could limit flexibility in terms of staffing and operational adjustments.