



Unveiling Expo 2020: A Data-Driven Journey Through Visitors, Pavilions, and Experiences

This is just the beginning of something big.

Made By: Umair Dada

CS 457 - Vidhyacharan Bhaskar

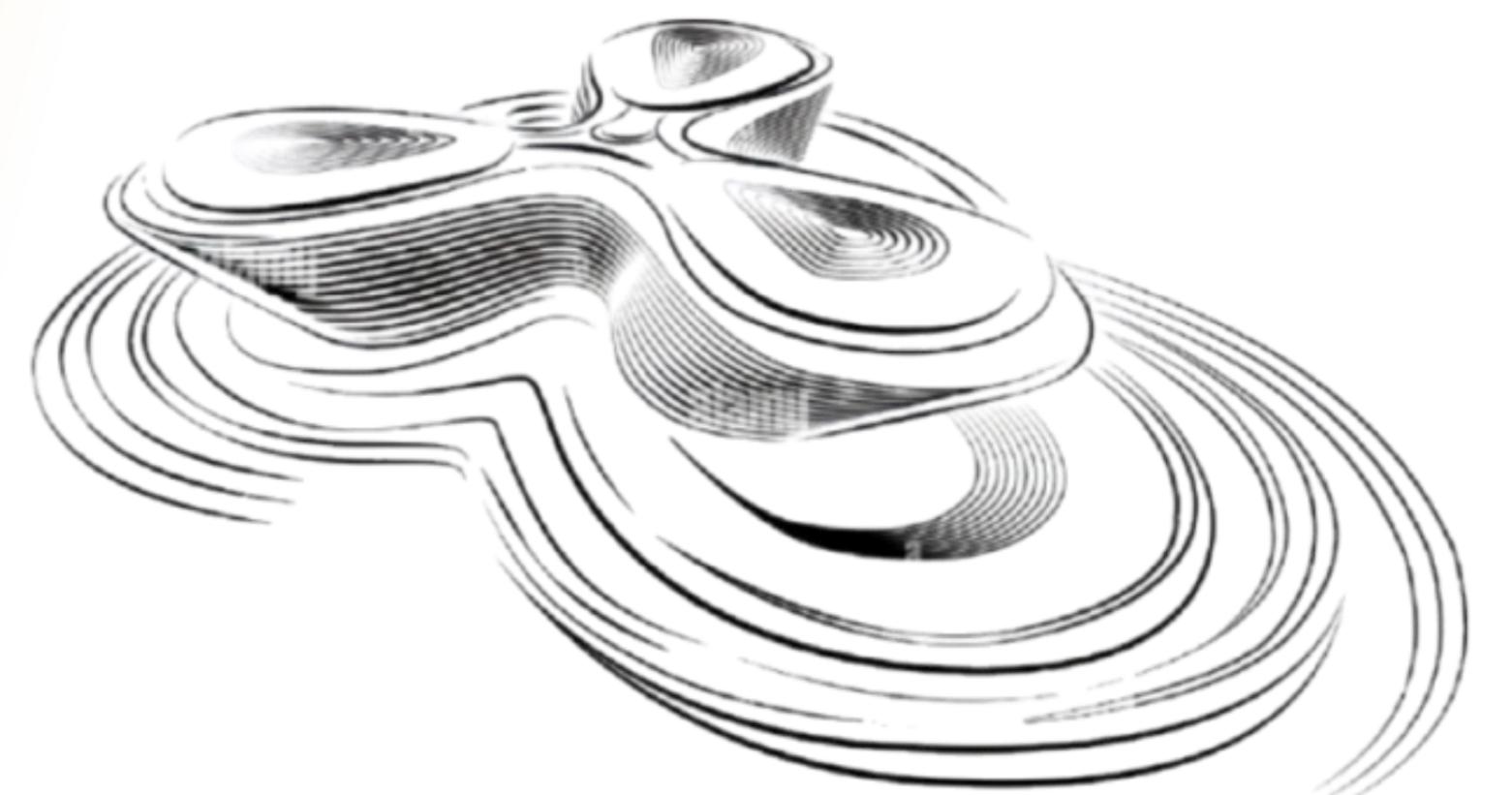


Table of Contents

1. To kick things off

Introduction, Problem Statement & Proposed Solution

2. Next up

Entities & Attributes

3. Here's the third gem

Relationships

4. Rolling right along

ER Diagram

5. Halfway there

Table Creation, Data Population & Table Output

6. Let's keep it going

Basic, Intermediate & Complex SQL Queries

7. Lucky number seven

Mathematical Notations

8. Almost at the finish line

Conclusion

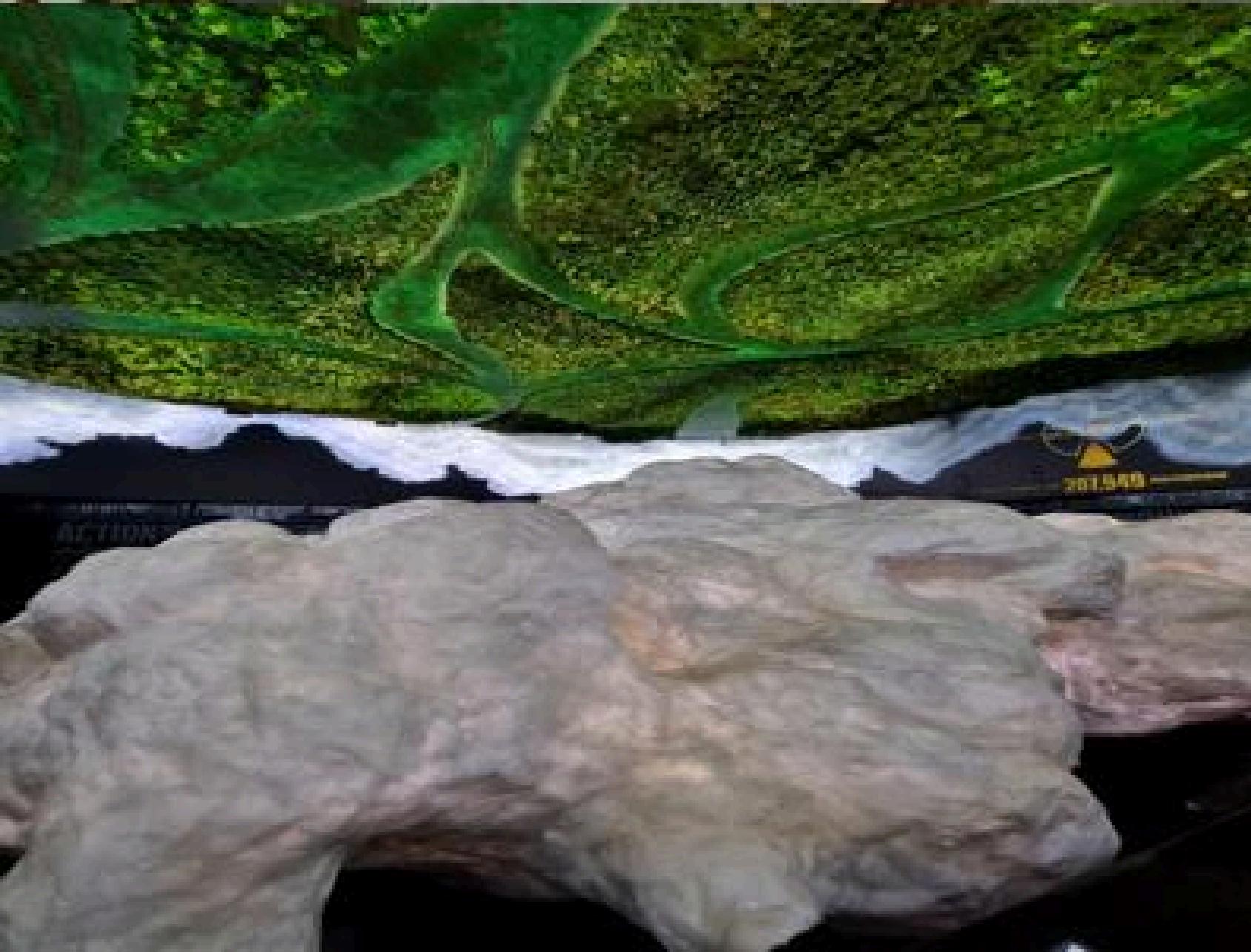
9. Wrapping it up with a bang!

References & Completion

Introduction

- **Expo 2020 Dubai:**
 - A global event held from October 2021 to March 2022, showcasing innovation, culture, and sustainability.
 - Spanned 192 countries, hosting millions of visitors.
- **Objective of the Digital Archive System:**
 - To create a centralized database for managing the construction, workforce, events, and exhibits of Expo 2020.
 - To ensure data organization, transparency, and future accessibility.
- **System Focus:**
 - Documenting relationships between contractors, subcontractors, pavilions, and materials.
 - Managing access through Construction Access Passes for accountability and security.
 - Providing structured data for audits, research, and event legacy preservation.

EXPO 2020 IMAGES (Taken By Me)



Problem Statement

Challenges at Expo 2020

- Managing construction data for multiple pavilions, contractors, and subcontractors.
- Regulating access through construction passes for security and accountability.
- Organizing information about events, exhibits, and visitors.

Lack of Centralized System

- Data scattered across multiple sources and formats.
- Inefficient tracking of relationships between entities.
- Limited ability to retrieve data for audits, research, or future reference.

Need for a Robust Solution

- Centralized database to ensure data integrity and accessibility.
- Simplify data management for contractors, materials, and workforce.
- Enable efficient reporting and support future scalability.

- **Expo 2020 Dubai:**

- A global event held from October 2021 to March 2022, showcasing innovation, culture, and sustainability.
- Spanned 192 countries, hosting millions of visitors.

- **Objective of the Digital Archive System:**

- To create a centralized database for managing the construction, workforce, events, and exhibits of Expo 2020.
- To ensure data organization, transparency, and future accessibility.

- **System Focus:**

- Documenting relationships between contractors, subcontractors, pavilions, and materials.
- Managing access through Construction Access Passes for accountability and security.
- Providing structured data for audits, research, and event legacy preservation.

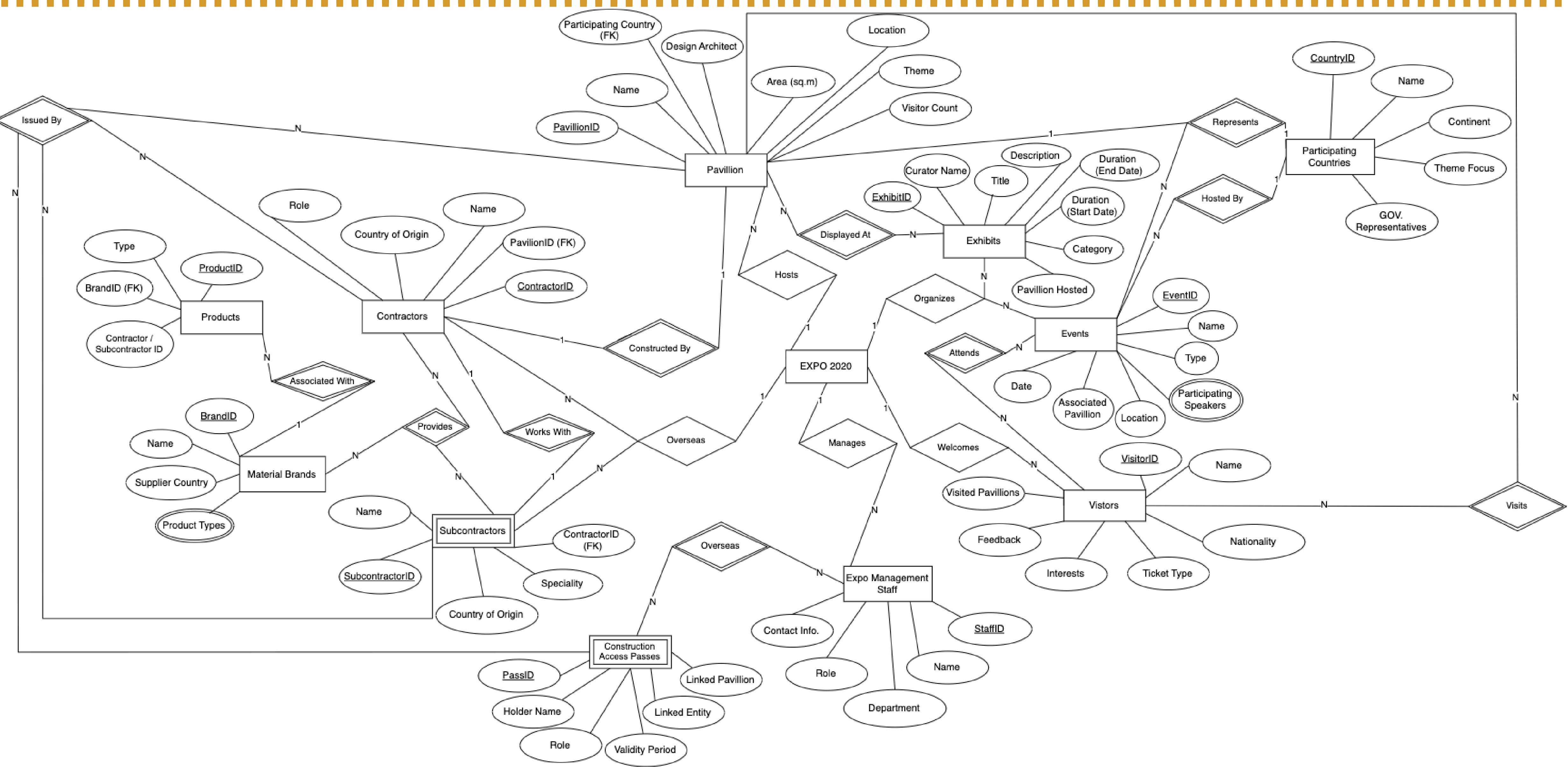
Proposed Solution

Entities & Attributes

- **EXPO2020:** EventID, Name, StartDate, EndDate, ThemeFocus.
- **Pavilions:** PavilionID, Name, ParticipatingCountry, Theme, Location, DesignArchitect, Area, VisitorCount.
- **Contractors:** ContractorID, Name, CountryOfOrigin, Role, PavilionID (Foreign Key).
- **Subcontractors:** SubcontractorID, Name, CountryOfOrigin, Specialty, ContractorID (Foreign Key).
- **Visitors:** VisitorID, Name, Nationality, TicketType, Interests, Feedback, VisitedPavilions.
- **Construction Access Passes:** PassID, HolderName, Role, DateIssued, ValidityPeriod, LinkedPavilion, LinkedEntity.
- **Material Brands:** BrandID, Name, SupplierCountry, ProductTypes.
- **Products:** ProductID, Name, Type, BrandID (Foreign Key), ContractorOrSubcontractorID.
- **Events:** EventID, Name, Type, Date, Location, AssociatedPavilion, ParticipatingSpeakers.
- **Exhibits:** ExhibitID, Title, Description, Category, PavilionHosted, StartDate, EndDate, CuratorName.
- **Expo Management Staff:** StaffID, Name, Department, Role, ContactInfo.

Relationship

- **EXPO2020 (1) - hosts - (M) Pavilions:** One Expo event hosts multiple pavilions.
- **Pavilions (1) - is constructed by - (M) Contractors:** A pavilion can involve multiple contractors for its construction.
- **Contractors (1) - hires - (M) Subcontractors:** A contractor can hire multiple subcontractors to handle specific tasks.
- **Subcontractors (1) - uses - (M) Products:** A subcontractor can use multiple products during their work.
- **Material Brands (1) - provides - (M) Products:** A material brand can manufacture multiple types of products.
- **EXPO2020 (1) - organizes - (M) Events:** One Expo event can organize multiple events.
- **Pavilions (1) - hosts - (M) Events:** A pavilion can host multiple events during Expo 2020.
- **Events (1) - features - (M) Exhibits:** An event can feature multiple exhibits.
- **Pavilions (1) - houses - (M) Exhibits:** A pavilion can house multiple exhibits.
- **Visitors (1) - attends - (M) Events:** A visitor can attend multiple events.
- **Visitors (1) - explores - (M) Pavilions:** A visitor can explore multiple pavilions.
- **EXPO2020 (1) - employs - (M) Expo Management Staff:** One Expo event employs multiple management staff members.
- **Construction Access Passes (1) - belongs to - (M) Contractors/Subcontractors:** A construction access pass can belong to multiple contractors or subcontractors for site regulation.



ER Diagram

EXPO2020 Table

Query

Purpose: Acts as the central entity of the system. Stores details about the Expo 2020 event.

```
1 CREATE TABLE EXP02020 (
2     EventID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     StartDate DATE NOT NULL,
5     EndDate DATE NOT NULL,
6     ThemeFocus ENUM('Mobility', 'Sustainability', 'Opportunity')
7 );
8
9 -- Insert data
10 INSERT INTO EXP02020 VALUES
11 (1, 'Expo 2020 Dubai', '2021-10-01', '2022-03-31', 'Sustainability');
```

Output

* EventID int	* Name varchar(255)	* StartDate date	* EndDate date	ThemeFocus enum('Mobility','Sustainabi
1	Expo 2020 Dubai	2021-10-01	2022-03-31	Sustainability

Create Table Query

Pavilion Table

Purpose: Represents the physical pavilions at the Expo. Stores details about their design, location, and participating country.

```
1 CREATE TABLE Pavilions (
2     PavilionID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     ParticipatingCountry VARCHAR(255),
5     Theme ENUM('Mobility', 'Sustainability', 'Opportunity'),
6     Location VARCHAR(255),
7     DesignArchitect VARCHAR(255),
8     Area DECIMAL(10, 2),
9     VisitorCount INT,
10    EventID INT,
11    FOREIGN KEY (EventID) REFERENCES EXP02020(EventID)
12 );
```

Insert Data Query

```
1 INSERT INTO Pavilions VALUES
2 (1, 'UAE Pavilion', 'United Arab Emirates', 'Sustainability', 'Zone A', 'Santiago Calatrava', 1500.00, 150000, 1),
3 (2, 'Germany Pavilion', 'Germany', 'Mobility', 'Zone B', 'LAVA Architects', 1200.00, 140000, 1),
4 (3, 'Japan Pavilion', 'Japan', 'Opportunity', 'Zone C', 'Yuko Nagayama', 1000.00, 130000, 1),
5 (4, 'India Pavilion', 'India', 'Sustainability', 'Zone A', 'CP Kukreja', 1600.00, 160000, 1),
6 (5, 'USA Pavilion', 'USA', 'Mobility', 'Zone B', 'Woods Bagot', 1400.00, 155000, 1),
7 (6, 'France Pavilion', 'France', 'Opportunity', 'Zone C', 'Jean Nouvel', 1100.00, 145000, 1),
8 (7, 'UK Pavilion', 'UK', 'Sustainability', 'Zone A', 'Es Devlin', 1300.00, 135000, 1),
9 (8, 'Saudi Arabia Pavilion', 'Saudi Arabia', 'Mobility', 'Zone B', 'Buro Happold', 1250.00, 125000, 1),
10 (9, 'Italy Pavilion', 'Italy', 'Opportunity', 'Zone C', 'Carlo Ratti', 1050.00, 120000, 1),
11 (10, 'Australia Pavilion', 'Australia', 'Sustainability', 'Zone A', 'COX Architecture', 1150.00, 110000, 1);
```

Pavilion Table

* PavilionID int	* Name varchar(255)	ParticipatingCountry varchar(255)	Theme enum('Mobility','Sustainabi	Location varchar(255)	DesignArchitect varchar(255)	Area decimal(10,2)	VisitorCount int	EventID int
1	UAE Pavilion	United Arab Emirates	Sustainability	Zone A	Santiago Calatrava	1500.00	150000	1
2	Germany Pavilion	Germany	Mobility	Zone B	LAVA Architects	1200.00	140000	1
3	Japan Pavilion	Japan	Opportunity	Zone C	Yuko Nagayama	1000.00	130000	1
4	India Pavilion	India	Sustainability	Zone A	CP Kukreja	1600.00	160000	1
5	USA Pavilion	USA	Mobility	Zone B	Woods Bagot	1400.00	155000	1
6	France Pavilion	France	Opportunity	Zone C	Jean Nouvel	1100.00	145000	1
7	UK Pavilion	UK	Sustainability	Zone A	Es Devlin	1300.00	135000	1
8	Saudi Arabia Pavilion	Saudi Arabia	Mobility	Zone B	Buro Happold	1250.00	125000	1
9	Italy Pavilion	Italy	Opportunity	Zone C	Carlo Ratti	1050.00	120000	1
10	Australia Pavilion	Australia	Sustainability	Zone A	COX Architecture	1150.00	110000	1

Contractors Table



```
1 CREATE TABLE Contractors (
2     ContractorID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     CountryOfOrigin VARCHAR(255),
5     Role VARCHAR(100),
6     PavilionID INT,
7     FOREIGN KEY (PavilionID) REFERENCES Pavilions(PavilionID)
8 );
```

Create Table Query



```
1 INSERT INTO Contractors VALUES
2 (1, 'ALEC Engineering', 'UAE', 'Construction', 1),
3 (2, 'Al Habtoor', 'UAE', 'Construction', 2),
4 (3, 'Laing O'Rourke', 'UK', 'Electrical', 3),
5 (4, 'Concorde Corodex', 'UAE', 'Plumbing', 4),
6 (5, 'Arabtec', 'UAE', 'Interior Design', 5),
7 (6, 'Hyundai Construction', 'South Korea', 'Construction', 6),
8 (7, 'VINCI', 'France', 'Construction', 7),
9 (8, 'Bechtel', 'USA', 'HVAC', 8),
10 (9, 'Samsung C&T', 'South Korea', 'Electrical', 9),
11 (10, 'Bouygues', 'France', 'Interior Design', 10);
12
```

Insert Data Query

Purpose: Stores information about contractors responsible for pavilion construction and related tasks.

Contractors Table

* ContractorID int	* Name varchar(255)	CountryOfOrigin varchar(255)	Role varchar(100)	PavilionID int
1	ALEC Engineering	UAE	Construction	1
2	AI Habtoor	UAE	Construction	2
3	Laing O'Rourke	UK	Electrical	3
4	Concorde Corodex	UAE	Plumbing	4
5	Arabtec	UAE	Interior Design	5
6	Hyundai Construction	South Korea	Construction	6
7	VINCI	France	Construction	7
8	Bechtel	USA	HVAC	8
9	Samsung C&T	South Korea	Electrical	9
10	Bouygues	France	Interior Design	10

Subcontractors Table



```
1 CREATE TABLE Subcontractors (
2     SubcontractorID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     CountryOfOrigin VARCHAR(255),
5     Specialty VARCHAR(100),
6     ContractorID INT,
7     FOREIGN KEY (ContractorID) REFERENCES Contractors(ContractorID)
8 );
```

Create Table Query



```
1 INSERT INTO Subcontractors VALUES
2 (1, 'ABT Steel Contracting', 'UAE', 'Structural Engineering', 1),
3 (2, 'FISCHER Middle East', 'Germany', 'Steel Fasteners', 2),
4 (3, 'Voltas', 'India', 'HVAC', 3),
5 (4, 'Dewatering Solutions', 'UK', 'Drainage', 4),
6 (5, 'Middle East Joinery', 'UAE', 'Carpentry', 5),
7 (6, 'Al Ahlia Electromechanical', 'UAE', 'Electrical', 6),
8 (7, 'Technal Middle East', 'France', 'Facade', 7),
9 (8, 'KONE', 'Finland', 'Elevators', 8),
10 (9, 'Aldes', 'France', 'Ventilation', 9),
11 (10, 'Knauf', 'Germany', 'Interior Partitions', 10);
```

Insert Data Query

Purpose: Represents the subcontractors hired by contractors for specialized tasks.

Subcontractors Table

* ContractorID int	* Name varchar(255)	CountryOfOrigin varchar(255)	Role varchar(100)	PavilionID int
1	ALEC Engineering	UAE	Construction	1
2	Al Habtoor	UAE	Construction	2
3	Laing O'Rourke	UK	Electrical	3
4	Concorde Corodex	UAE	Plumbing	4
5	Arabtec	UAE	Interior Design	5
6	Hyundai Construction	South Korea	Construction	6
7	VINCI	France	Construction	7
8	Bechtel	USA	HVAC	8
9	Samsung C&T	South Korea	Electrical	9
10	Bouygues	France	Interior Design	10

Visitors Table



```
1 CREATE TABLE Visitors (
2     VisitorID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     Nationality VARCHAR(255),
5     TicketType ENUM('General', 'VIP'),
6     Interests TEXT,
7     Feedback TEXT,
8     VisitedPavilions TEXT
9 );
```

Create Table Query

Insert Table Query: Python, SQL, and a custom library were used to generate and insert 200,000 realistic visitor records efficiently into the database.

Purpose: Represents the subcontractors hired by contractors for specialized tasks.

Visitors Table

* VisitorID int	* Name varchar(255)	Nationality varchar(255)	TicketType enum('General','VIP')	Interests text	Feedback text	VisitedPavilions text
1	Caroline Valdez	Australia	General	Science	The food and hospitality added a special touch.	Italy Pavilion
2	Christopher Hughes	Germany	General	Technology	An absolute must-visit!	USA Pavilion, Italy Pavilion
3	John Sanchez	India	General	Technology, Sustainability	Enjoyed the exhibits.	Japan Pavilion, UK Pavilion, Saudi Pavilion
4	Michael Wade	France	VIP	Culture, Mobility, Innovation	A great learning opportunity for the mind.	Japan Pavilion
5	Gina Miller	USA	VIP	Technology, Science, Innovation	The design was breathtaking.	Japan Pavilion, UAE Pavilion, London Pavilion

6 ---- 199,995 (Inserted using Python)

199996	Annette Patterson	Germany	VIP	Innovation, Art	It felt like traveling into the future.	UAE Pavilion
199997	William West	Saudi Arabia	General	Mobility, Art, Sustainability	Exceeded my expectations in every aspect.	Japan Pavilion, USA Pavilion
199998	Richard House MD	Germany	VIP	Science, Technology	The exhibits told a powerful story.	UK Pavilion
199999	Karen Odom	Saudi Arabia	VIP	Art, Technology	The pavilion was beautifully organized.	Italy Pavilion, France Pavilion
200000	Michael Ortiz	Germany	VIP	Science, Innovation	The art exhibits were extraordinary.	Australia Pavilion

Material Brands Table



```
1 CREATE TABLE MaterialBrands (
2     BrandID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     SupplierCountry VARCHAR(255),
5     ProductTypes TEXT
6 );
```

Create Table Query



```
1 INSERT INTO MaterialBrands VALUES
2 (1, 'CAT', 'USA', 'Heavy Equipment, Tools'),
3 (2, 'FISCHER', 'Germany', 'Steel Fasteners, Anchors'),
4 (3, 'Hilti', 'Switzerland', 'Construction Tools, Fastening'),
5 (4, 'Knauf', 'Germany', 'Interior Systems, Drywalls'),
6 (5, 'Jotun', 'Norway', 'Paints, Coatings'),
7 (6, 'Technal', 'France', 'Aluminium Systems, Facades'),
8 (7, 'Bosch', 'Germany', 'Power Tools, Appliances'),
9 (8, 'Samsung', 'South Korea', 'Electrical Components, Displays'),
10 (9, 'Panasonic', 'Japan', 'Electronics, Solar Panels'),
11 (10, 'LG', 'South Korea', 'HVAC, Home Appliances');
```

Insert Data Query

Purpose: Stores information about brands providing materials or products used in pavilion construction.

Material Brands Table

* BrandID int	* Name varchar(255)	SupplierCountry varchar(255)	ProductTypes text
1	CAT	USA	Heavy Equipment, Tools
2	FISCHER	Germany	Steel Fasteners, Anchors
3	Hilti	Switzerland	Construction Tools, Fastening
4	Knauf	Germany	Interior Systems, Drywalls
5	Jotun	Norway	Paints, Coatings
6	Technal	France	Aluminium Systems, Facades
7	Bosch	Germany	Power Tools, Appliances
8	Samsung	South Korea	Electrical Components, Displays
9	Panasonic	Japan	Electronics, Solar Panels
10	LG	South Korea	HVAC, Home Appliances

Create Table Query

Products Table

Purpose: Represents specific products used by contractors and subcontractors during pavilion construction.

```
● ● ●  
1 CREATE TABLE Products (  
2     ProductID INT PRIMARY KEY,  
3     Name VARCHAR(255) NOT NULL,  
4     Type VARCHAR(100), -- Equipment, Steel, Electrical Components, etc.  
5     BrandID INT,  
6     ContractorOrSubcontractorID INT,  
7     FOREIGN KEY (BrandID) REFERENCES MaterialBrands(BrandID),  
8     FOREIGN KEY (ContractorOrSubcontractorID) REFERENCES Subcontractors(SubcontractorID)  
9 );
```

```
● ● ●  
1 INSERT INTO Products VALUES  
2 (1, 'Excavator', 'Heavy Equipment', 1, 1), -- Provided by CAT to ABT Steel Contracting  
3 (2, 'Steel Beams', 'Steel', 2, 1), -- Provided by FISCHER to ABT Steel Contracting  
4 (3, 'Concrete Drill', 'Construction Tools', 3, 2), -- Provided by Hilti to FISCHER Middle East  
5 (4, 'Drywall Panels', 'Interior Systems', 4, 3), -- Provided by Knauf to Voltas  
6 (5, 'Weather-Resistant Paint', 'Paints', 5, 4), -- Provided by Jotun to Dewatering Solutions  
7 (6, 'Aluminum Facade System', 'Facades', 6, 1), -- Provided by Technal to ABT Steel Contracting  
8 (7, 'Power Tools', 'Tools', 7, 5), -- Provided by Bosch to Middle East Joinery  
9 (8, 'Solar Panel Display', 'Electronics', 9, 8), -- Provided by Panasonic to KONE  
10 (9, 'Air Conditioning Unit', 'HVAC', 10, 6), -- Provided by LG to Al Ahlia Electromechanical  
11 (10, 'Anchor Bolts', 'Steel Fasteners', 2, 10); -- Provided by FISCHER to Knauf
```

Insert Data Query

Products Table

* ProductID int	* Name varchar(255)	Type varchar(100)	BrandID int	ContractorOrSubcontractorID int
1	Excavator	Heavy Equipment	1	1
2	Steel Beams	Steel	2	1
3	Concrete Drill	Construction Tools	3	2
4	Drywall Panels	Interior Systems	4	3
5	Weather-Resistant Paint	Paints	5	4
6	Aluminum Facade System	Facades	6	1
7	Power Tools	Tools	7	5
8	Solar Panel Display	Electronics	9	8
9	Air Conditioning Unit	HVAC	10	6
10	Anchor Bolts	Steel Fasteners	2	10

Create Table Query

Events Table

Purpose: Stores information about events organized during Expo 2020.

```
1 CREATE TABLE Events (
2     EventID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     Type VARCHAR(100),
5     Date DATE,
6     Location VARCHAR(255),
7     AssociatedPavilion INT,
8     ParticipatingSpeakers TEXT,
9     FOREIGN KEY (AssociatedPavilion) REFERENCES Pavilions(PavilionID)
10 );
```

```
1 INSERT INTO Events VALUES
2 (1, 'Sustainability Conference', 'Conference', '2021-10-15', 'UAE Pavilion', 1, 'Dr. Jane Doe, Dr. Ahmed Malik'),
3 (2, 'Mobility Workshop', 'Workshop', '2021-11-20', 'Germany Pavilion', 2, 'Mr. Hans Meier'),
4 (3, 'Opportunity Seminar', 'Seminar', '2021-12-10', 'Japan Pavilion', 3, 'Prof. Yuko Tanaka'),
5 (4, 'Cultural Performance', 'Performance', '2021-10-25', 'India Pavilion', 4, 'Bollywood Dance Troupe'),
6 (5, 'Future Technology Expo', 'Exhibition', '2021-11-05', 'USA Pavilion', 5, 'Tech Innovators Panel'),
7 (6, 'Green Energy Summit', 'Conference', '2021-12-01', 'France Pavilion', 6, 'Mr. Pierre Dupont'),
8 (7, 'Smart City Talk', 'Seminar', '2021-11-15', 'UK Pavilion', 7, 'Dr. Emily Watson'),
9 (8, 'Desert Ecosystem Presentation', 'Presentation', '2021-12-20', 'Saudi Arabia Pavilion', 8, 'Dr. Abdullah Khalid'),
10 (9, 'Art and Design Showcase', 'Exhibition', '2021-10-30', 'Italy Pavilion', 9, 'Carlo Ratti Design Team'),
11 (10, 'Solar Power Workshop', 'Workshop', '2021-11-25', 'Australia Pavilion', 10, 'Dr. Lisa Brown');
```

Insert Data Query

Events Table

* EventID int	* Name varchar(255)	Type varchar(100)	Date date	Location varchar(255)	AssociatedPavilion int	ParticipatingSpeakers text
1	Sustainability Conference	Conference	2021-10-15	UAE Pavilion	1	Dr. Jane Doe, Dr. Ahmed Malik
2	Mobility Workshop	Workshop	2021-11-20	Germany Pavilion	2	Mr. Hans Meier
3	Opportunity Seminar	Seminar	2021-12-10	Japan Pavilion	3	Prof. Yuko Tanaka
4	Cultural Performance	Performance	2021-10-25	India Pavilion	4	Bollywood Dance Troupe
5	Future Technology Expo	Exhibition	2021-11-05	USA Pavilion	5	Tech Innovators Panel
6	Green Energy Summit	Conference	2021-12-01	France Pavilion	6	Mr. Pierre Dupont
7	Smart City Talk	Seminar	2021-11-15	UK Pavilion	7	Dr. Emily Watson
8	Desert Ecosystem Presentation	Presentation	2021-12-20	Saudi Arabia Pavilion	8	Dr. Abdullah Khalid
9	Art and Design Showcase	Exhibition	2021-10-30	Italy Pavilion	9	Carlo Ratti Design Team
10	Solar Power Workshop	Workshop	2021-11-25	Australia Pavilion	10	Dr. Lisa Brown

Create Table Query

Exhibits Table

Purpose: Tracks exhibits displayed in pavilions during the Expo.

```
1 CREATE TABLE Exhibits (
2     ExhibitID INT PRIMARY KEY,
3     Title VARCHAR(255) NOT NULL,
4     Description TEXT,
5     Category VARCHAR(100),
6     PavilionHosted INT,
7     StartDate DATE,
8     EndDate DATE,
9     CuratorName VARCHAR(255),
10    FOREIGN KEY (PavilionHosted) REFERENCES Pavilions(PavilionID)
11 );
```



```
1 INSERT INTO Exhibits VALUES
2 (1, 'Sustainable Cities', 'Showcasing green architecture designs.', 'Technology', 1, '2021-10-01', '2021-11-30', 'John Green'),
3 (2, 'Innovative Mobility', 'Featuring future transportation solutions.', 'Technology', 2, '2021-10-10', '2021-12-10', 'Anna Schmidt'),
4 (3, 'Cultural Exchange', 'Highlighting cultural artifacts and traditions.', 'Culture', 3, '2021-10-20', '2021-12-31', 'Yuko Nagayama'),
5 (4, 'India\'s Heritage', 'A celebration of India\'s history and culture.', 'Art', 4, '2021-11-01', '2021-12-15', 'Rajesh Kapoor'),
6 (5, 'American Innovation', 'Tech-driven advancements in the USA.', 'Technology', 5, '2021-11-10', '2021-12-25', 'Sarah Johnson'),
7 (6, 'Art de France', 'French art and design through the ages.', 'Art', 6, '2021-10-15', '2021-12-05', 'Pierre Leclerc'),
8 (7, 'Future of Education', 'Smart education tools for the next generation.', 'Technology', 7, '2021-11-05', '2021-12-20', 'Emily Watson'),
9 (8, 'Desert Ecosystems', 'Understanding the unique ecosystems of deserts.', 'Science', 8, '2021-10-25', '2021-11-20', 'Abdullah Khalid'),
10 (9, 'Italian Renaissance', 'Exploring the art and architecture of Italy.', 'Art', 9, '2021-11-15', '2021-12-30', 'Giovanni Rossi'),
11 (10, 'Solar Future', 'Advancing solar power technologies.', 'Technology', 10, '2021-10-05', '2021-11-25', 'Lisa Brown');
```

Insert Data Query

Exhibits Table

* ExhibitID int	* Title varchar(255)	Description text	Category varchar(100)	PavilionHosted int	StartDate date	EndDate date	CuratorName varchar(255)
1	Sustainable Cities	Showcasing green architecture and sustainable living solutions.	Technology	1	2021-10-01	2021-11-30	John Green
2	Innovative Mobility	Featuring future transportation technologies and electric vehicles.	Technology	2	2021-10-10	2021-12-10	Anna Schmidt
3	Cultural Exchange	Highlighting cultural artifacts from around the world and their significance.	Culture	3	2021-10-20	2021-12-31	Yuko Nagayama
4	India's Heritage	A celebration of India's history, culture, and traditional crafts.	Art	4	2021-11-01	2021-12-15	Rajesh Kapoor
5	American Innovation	Tech-driven advancements in various industries across the United States.	Technology	5	2021-11-10	2021-12-25	Sarah Johnson
6	Art de France	French art and design through the ages, featuring works by Renoir and Degas.	Art	6	2021-10-15	2021-12-05	Pierre Leclerc
7	Future of Education	Smart education tools for the modern classroom and future learning trends.	Technology	7	2021-11-05	2021-12-20	Emily Watson
8	Desert Ecosystems	Understanding the unique ecology and biodiversity of desert environments.	Science	8	2021-10-25	2021-11-20	Abdullah Khalid
9	Italian Renaissance	Exploring the art and architecture of the Italian Renaissance period.	Art	9	2021-11-15	2021-12-30	Giovanni Rossi
10	Solar Future	Advancing solar power technology and its role in a sustainable future.	Technology	10	2021-10-05	2021-11-25	Lisa Brown

Expo Management Staff Table



```
1 CREATE TABLE ExpoManagementStaff (
2     StaffID INT PRIMARY KEY,
3     Name VARCHAR(255) NOT NULL,
4     Department VARCHAR(100),
5     Role VARCHAR(100),
6     ContactInfo VARCHAR(255),
7     EventID INT,
8     FOREIGN KEY (EventID) REFERENCES EXP02020(EventID)
9 );
```

Create Table Query



```
1 INSERT INTO ExpoManagementStaff VALUES
2 (1, 'Ali Khan', 'Security', 'Manager', 'ali.khan@example.com', 1),
3 (2, 'Sara Ahmed', 'Logistics', 'Coordinator', 'sara.ahmed@example.com', 1),
4 (3, 'John Doe', 'Operations', 'Supervisor', 'john.doe@example.com', 1),
5 (4, 'Mary Ann', 'Security', 'Personnel', 'mary.ann@example.com', 1),
6 (5, 'Ahmed Hassan', 'Logistics', 'Driver', 'ahmed.hassan@example.com', 1),
7 (6, 'Jessica Lee', 'Operations', 'Engineer', 'jessica.lee@example.com', 1),
8 (7, 'Carlos Martinez', 'Security', 'Guard', 'carlos.martinez@example.com', 1),
9 (8, 'Amira Suleiman', 'Logistics', 'Planner', 'amira.suleiman@example.com', 1),
10 (9, 'Ravi Sharma', 'Operations', 'Technician', 'ravi.sharma@example.com', 1),
11 (10, 'Elena Petrova', 'Security', 'Patrol', 'elena.petrova@example.com', 1);
```

Insert Data Query

Purpose: Tracks staff members involved in the management and operations of Expo 2020.

Expo Management Staff Table

* StaffID int	* Name varchar(255)	Department varchar(100)	Role varchar(100)	ContactInfo varchar(255)	EventID int
1	Ali Khan	Security	Manager	ali.khan@example.com	1
2	Sara Ahmed	Logistics	Coordinator	sara.ahmed@example.com	1
3	John Doe	Operations	Supervisor	john.doe@example.com	1
4	Mary Ann	Security	Personnel	mary.ann@example.com	1
5	Ahmed Hassan	Logistics	Driver	ahmed.hassan@example.com	1
6	Jessica Lee	Operations	Engineer	jessica.lee@example.com	1
7	Carlos Martinez	Security	Guard	carlos.martinez@example.com	1
8	Amira Suleiman	Logistics	Planner	amira.suleiman@example.com	1
9	Ravi Sharma	Operations	Technician	ravi.sharma@example.com	1
10	Elena Petrova	Security	Patrol	elena.petrova@example.com	1

Basic Queries

Foundational Queries for Data Retrieval and Insights

List All Contractors for a Specific Pavilion

Purpose

Fetches the names and roles of contractors working on a specific pavilion (e.g., PavilionID = 1). Helps in identifying who is responsible for specific construction tasks.

Query

```
SELECT Name, Role  
FROM Contractors  
WHERE PavilionID = 1;
```

Name	Role
ALEC Engineering	Construction

Find Visitors Interested in Technology and Sort Them by Feedback Length

Purpose

Filters visitors who have "Technology" as one of their interests using the WHERE clause. Orders the filtered results by the length of their feedback in descending order to highlight the most engaged visitors.

Query

```
SELECT Name AS VisitorName, Interests,  
LENGTH(Feedback) AS FeedbackLength  
FROM Visitors  
WHERE FIND_IN_SET('Technology', Interests) > 0  
ORDER BY FeedbackLength DESC;
```

VisitorName varchar	Interests text	FeedbackLength bigint
Daniel King	Technology, Sustainability, Art	54
Victoria Glover	Technology, Science, Sustainability	54
Tyler Carpenter	Technology	54
Patrick Burton	Technology, Art	54
Michael Conway	Technology, Art, Mobility	54

Find Visitors Who Gave Positive Feedback

Purpose

Lists all visitors who provided positive feedback.
Useful for analyzing visitor satisfaction and the success of the event.

Query

```
SELECT Name, Feedback  
FROM Visitors  
WHERE Feedback LIKE '%amazing%' OR  
Feedback LIKE '%loved%';
```

* Name varchar(255)	Feedback text
Ravi Martinez	Amazing experience!
Ali Lee	Amazing experience!
Lisa Patel	Loved the pavilion!
Hans Johnson	Amazing experience!
Hans Martinez	Loved the pavilion!

Get All Events Hosted in a Specific Pavilion

Purpose

Retrieves all events hosted in a specific pavilion (e.g., PavilionID = 1). Useful for understanding pavilion usage and event scheduling.

Query

```
SELECT Name, Type, Date  
FROM Events  
WHERE AssociatedPavilion = 1;
```

* Name varchar(255)	Type varchar(100)	Date date
Sustainability Conference	Conference	2021-10-15

Count the Total Number of Staff Members

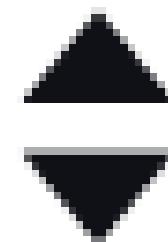
Purpose

Calculates the total number of Expo management staff members. Useful for understanding staffing requirements and resource allocation.

Query

```
SELECT COUNT(*) AS TotalStaff  
FROM ExpoManagementStaff;
```

TotalStaff
bigint



Intermediate Queries

Deeper Insights Through Multi-Table Interactions

Find Staff Members Assigned to Security with Their Contact Information

Purpose

Identifies the top 3 pavilions attracting visitors interested in "Art." Groups data by pavilion, counts unique visitors, and sorts them by visitor interest in descending order.

PavilionName varchar	ArtInterestedVisitors bigint
Saudi Arabia Pavilion	2930
Germany Pavilion	2920
Australia Pavilion	2900

Query

```
SELECT Pavilions.Name AS PavilionName,  
       COUNT(DISTINCT Visitors.VisitorID) AS  
   ArtInterestedVisitors  
FROM Pavilions  
JOIN Visitors ON FIND_IN_SET(Pavilions.Name,  
    Visitors.VisitedPavilions) > 0  
WHERE FIND_IN_SET('Art', Visitors.Interests) > 0  
GROUP BY Pavilions.Name  
ORDER BY ArtInterestedVisitors DESC  
LIMIT 3;
```

Find Total Visitor Count for Each Pavilion

Purpose

Aggregates the total number of visitors for each pavilion. Useful for analyzing which pavilions attracted the most visitors and understanding visitor distribution.

Query

```
SELECT Pavilions.Name AS PavilionName,  
SUM(VisitorCount) AS TotalVisitors  
FROM Pavilions  
GROUP BY Pavilions.Name  
ORDER BY TotalVisitors DESC;
```

	PavilionName varchar	TotalVisitors newdecimal		PavilionName varchar	TotalVisitors newdecimal	
> 1	India Pavilion	160000		> 6	UK Pavilion	135000
> 2	USA Pavilion	155000		> 7	Japan Pavilion	130000
> 3	UAE Pavilion	150000		> 8	Saudi Arabia Pavilion	125000
> 4	France Pavilion	145000		> 9	Italy Pavilion	120000
> 5	Germany Pavilion	140000		> 10	Australia Pavilion	110000

List Contractors and Their Subcontractors for a Specific Pavilion

Purpose

Displays the contractors and their subcontractors working on a specific pavilion.

Useful for understanding the workforce hierarchy and task delegation within a pavilion.

Query

```
SELECT Contractors.Name AS ContractorName,  
Subcontractors.Name AS SubcontractorName  
FROM Contractors  
JOIN Subcontractors ON  
Contractors.ContractorID =  
Subcontractors.ContractorID  
WHERE Contractors.PavilionID = 1;
```

ContractorName
varchar

SubcontractorName
varchar

ALEC Engineering

ABT Steel Contracting

Find Events and the Total Exhibits They Feature

Purpose

Counts the number of exhibits featured in each event. Useful for evaluating the scale of each event in terms of exhibits hosted.

Query

```
SELECT Events.Name AS EventName,  
COUNT(Exhibits.ExhibitID) AS TotalExhibits  
FROM Events  
LEFT JOIN Exhibits ON Events.AssociatedPavilion =  
Exhibits.PavilionHosted  
GROUP BY Events.Name  
ORDER BY TotalExhibits DESC;
```

	EventName varchar	TotalExhibits bigint		EventName varchar	TotalExhibits bigint
> 1	Sustainability Conference	1	> 6	Green Energy Summit	1
> 2	Mobility Workshop	1	> 7	Smart City Talk	1
> 3	Opportunity Seminar	1	> 8	Desert Ecosystem Presentatio	1
> 4	Cultural Performance	1	> 9	Art and Design Showcase	1
> 5	Future Technology Expo	1	> 10	Solar Power Workshop	1

Retrieve All Products Used by Subcontractors of a Specific Contractor

Purpose

Retrieves all products used by subcontractors working under a specific contractor. Useful for tracking material usage and ensuring accountability.

Query

```
SELECT Products.Name AS ProductName,  
Subcontractors.Name AS SubcontractorName  
FROM Products  
JOIN Subcontractors ON  
Products.ContractorOrSubcontractorID =  
Subcontractors.SubcontractorID  
WHERE Subcontractors.ContractorID = 1;
```

ProductName
varchar

SubcontractorName
varchar

Excavator

ABT Steel Contracting

Steel Beams

ABT Steel Contracting

Aluminum Facade System

ABT Steel Contracting

Complex Queries

Advanced Queries for Comprehensive Analysis

Pavilion with the Most Revenue Contribution to the Highest-Performing Pavilion

Purpose

This query calculates the revenue contribution of each pavilion as a percentage of the revenue generated by the highest-performing pavilion in terms of visitor count. Useful for comparing individual pavilion revenue with the top pavilion to evaluate relative performance.

PavilionName varchar	RevenueContribution varchar
Saudi Arabia Pavilion	99.96 %

Query

```
SELECT Pavilions.Name AS PavilionName,
CONCAT(FORMAT((SUM(CASE
WHEN Visitors.TicketType = 'VIP' THEN 500
ELSE 100
END) / (SELECT SUM(CASE
WHEN Visitors.TicketType = 'VIP'
THEN 500
ELSE 100
END)
FROM Visitors
JOIN Pavilions
ON FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0
WHERE Pavilions.PavilionID =
(SELECT PavilionID
FROM Pavilions
WHERE VisitorCount =
(SELECT MAX(VisitorCount
FROM Pavilions))
)) * 100, 2), ' %') AS RevenueContribution
FROM Pavilions
JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0
GROUP BY Pavilions.Name
ORDER BY RevenueContribution DESC
LIMIT 1;
```

Find the Pavilion with the Most Unique Visitor Feedback Length Compared to the Average

Purpose

Finds the pavilion with the longest average visitor feedback length compared to the overall Expo feedback average. Useful for identifying which pavilion inspired the most detailed feedback from visitors and how it differs from the general trend.

Query

```
SELECT Pavilions.Name AS PavilionName,
       AVG(LENGTH(Visitors.Feedback)) AS
     AvgFeedbackLength,
       (SELECT AVG(LENGTH(Visitors.Feedback))
        FROM Visitors
        WHERE FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0) AS PavilionAverageFeedback,
       CONCAT(FORMAT(AVG(LENGTH(Visitors.Feedback)) -
(SELECT AVG(LENGTH(Visitors.Feedback))
        FROM Visitors), 2), ' characters') AS
DifferenceFromOverallAvg
  FROM Pavilions
 JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0
 GROUP BY Pavilions.Name
 ORDER BY DifferenceFromOverallAvg DESC
 LIMIT 1;
```

PavilionName varchar	AvgFeedbackLength newdecimal	PavilionAverageFeedback newdecimal	DifferenceFromOverallAvg varchar
Australia Pavilion	36.9031	36.9031	0.11 characters

Top 5 Pavilions by Visitor Engagement (Events + Exhibits)

Purpose

Ranks top 5 pavilions by their total number of events and exhibits combined into an engagement score. Useful for analyzing pavilion activity levels and their ability to engage visitors.

PavilionName varchar	TotalEvents bigint	TotalExhibits bigint	EngagementScore bigint
Australia Pavilion	1	1	2
France Pavilion	1	1	2
Germany Pavilion	1	1	2
India Pavilion	1	1	2
Italy Pavilion	1	1	2

Query

```
SELECT Pavilions.Name AS PavilionName,
       COUNT(DISTINCT Events.EventID) AS TotalEvents,
       COUNT(DISTINCT Exhibits.ExhibitID) AS TotalExhibits,
       (COUNT(DISTINCT Events.EventID) +
        COUNT(DISTINCT Exhibits.ExhibitID)) AS EngagementScore
  FROM Pavilions
 LEFT JOIN Events ON Pavilions.PavilionID =
   Events.AssociatedPavilion
 LEFT JOIN Exhibits ON Pavilions.PavilionID =
   Exhibits.PavilionHosted
 GROUP BY Pavilions.Name
 ORDER BY EngagementScore DESC
 LIMIT 5;
```

List Top Visitors by the Number of Pavilions Explored and Their Interests

Purpose

Identifies the top 10 visitors who explored the most pavilions and lists their interests. Useful for understanding visitor behavior and tailoring future marketing efforts.

VisitorName varchar	TotalPavilionsVisited bigint	Interests text
Michael Johnson	6	Art
Michael Lee	6	Mobility
Christopher Johnson	6	Science
David Brown	5	Innovation
Michael Johnson	5	Culture

Query

```
SELECT Visitors.Name AS VisitorName,  
       COUNT(DISTINCT Pavilions.Name) AS  
   TotalPavilionsVisited,  
       Visitors.Interests  
  FROM Visitors  
 JOIN Pavilions ON FIND_IN_SET(Pavilions.Name,  
   Visitors.VisitedPavilions) > 0  
 GROUP BY Visitors.Name, Visitors.Interests  
 ORDER BY TotalPavilionsVisited DESC  
 LIMIT 5;
```

Find the Pavilion with the Most Contractors and Analyze Visitor Satisfaction

Purpose

Identifies the pavilion with the most contractors and evaluates visitor satisfaction based on feedback length. Useful for understanding the relationship between construction efforts and visitor experience.

PavilionName varchar	TotalContractors bigint	AvgFeedbackLength newdecimal
Australia Pavilion	1	36.9031

Query

```
SELECT Pavilions.Name AS PavilionName,  
       COUNT(DISTINCT  
Contractors.ContractorID) AS TotalContractors,  
       AVG(LENGTH(Visitors.Feedback)) AS  
AvgFeedbackLength  
  FROM Pavilions  
 JOIN Contractors ON Pavilions.PavilionID =  
Contractors.PavilionID  
 JOIN Visitors ON FIND_IN_SET(Pavilions.Name,  
Visitors.VisitedPavilions) > 0  
 GROUP BY Pavilions.Name  
 ORDER BY TotalContractors DESC,  
AvgFeedbackLength DESC  
LIMIT 1;
```

Basic Mathematical Notations

Simplifying Data Analysis Through Math

Find Total Revenue Generated by Pavilions

Purpose

This notation represents a projection operation ($\pi \setminus \rho \pi \pi$) on the revenue, calculated by summing ticket prices ($\sum \setminus \sum \Sigma$) grouped by pavilion. It evaluates the financial performance of each pavilion by considering ticket sales.

PavilionName varchar	TotalRevenue varchar
Italy Pavilion	5,948,000 AED
USA Pavilion	6,044,600 AED
Japan Pavilion	5,890,400 AED
Australia Pavilion	6,000,000 AED
Saudi Arabia Pavilion	6,003,800 AED

Mathematical Notations

$$\pi_{\text{Revenue}}(\sum(\text{TicketType}))$$

Query

```
SELECT Pavilions.Name AS PavilionName,  
       SUM(CASE  
             WHEN Visitors.TicketType = 'VIP' THEN 500  
             ELSE 100  
           END) AS TotalRevenue  
  FROM Pavilions  
 JOIN Visitors ON FIND_IN_SET(Pavilions.Name,  
                               Visitors.VisitedPavilions) > 0  
 GROUP BY Pavilions.Name;
```

Calculate Average Visitor Count Per Pavilion

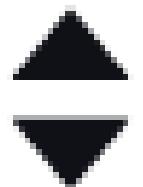
Purpose

This notation represents the average operation (\bar{X}), applied to the visitor counts of all pavilions. It helps to identify the mean attendance level per pavilion, providing insights into general visitor distribution.

Mathematical Notations

$$\bar{X}(\text{VisitorCount})_{\text{Pavilions}}$$

AvgVisitorCount
varchar



137,000

Query

```
SELECT FORMAT(AVG(VisitorCount), 0) AS  
AvgVisitorCount  
FROM Pavilions;
```

Rank Pavilions by Engagement Score

Purpose

This notation represents the ranked projection ($\text{Rank}(\pi) \backslash \text{text}{Rank}$) of engagement scores, calculated by summing the number of events and exhibits for each pavilion. It ranks pavilions based on their ability to engage visitors.

Mathematical Notation

$$\text{Rank}(\pi_{\text{EngagementScore}}(\sum(\text{Events} + \text{Exhibits})))$$

PavilionName varchar	◆	TotalEvents bigint	◆	TotalExhibits bigint	◆	EngagementScore bigint	◆
Australia Pavilion	◆	1	◆	1	◆	2	◆
France Pavilion	◆	1	◆	1	◆	2	◆
Germany Pavilion	◆	1	◆	1	◆	2	◆
India Pavilion	◆	1	◆	1	◆	2	◆
Italy Pavilion	◆	1	◆	1	◆	2	◆

Query

```
SELECT Pavilions.Name AS PavilionName,  
       COUNT(DISTINCT Events.EventID) AS  
TotalEvents,  
       COUNT(DISTINCT Exhibits.ExhibitID) AS  
TotalExhibits,  
       (COUNT(DISTINCT Events.EventID) +  
        COUNT(DISTINCT Exhibits.ExhibitID)) AS  
EngagementScore  
FROM Pavilions  
LEFT JOIN Events ON Pavilions.PavilionID =  
Events.AssociatedPavilion  
LEFT JOIN Exhibits ON Pavilions.PavilionID =  
Exhibits.PavilionHosted  
GROUP BY Pavilions.Name  
ORDER BY EngagementScore DESC  
LIMIT 5;
```

Advanced Mathematical Notations

Unveiling Deep Insights with Advanced Aggregations

Find Pavilion with the Most Revenue Per Visitor

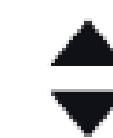
Purpose

This query calculates Revenue Per Visitor by dividing the total ticket revenue by the number of unique visitors for each pavilion. Useful for understanding which pavilion provides the highest value per visitor, highlighting efficient revenue generation.

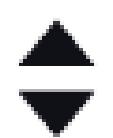
Mathematical Notation

$$\pi_{\text{PavilionName}, \text{RevenuePerVisitor}} \left(\frac{\sum(\text{Revenue})}{\sum(\text{Visitors})} \right)$$

PavilionName
varchar



RevenuePerVisitor
varchar



India Pavilion

301.11 AED

Query

```
SELECT Pavilions.Name AS PavilionName,  
       CONCAT(FORMAT(SUM(CASE  
                           WHEN Visitors.TicketType = 'VIP' THEN  
                               500  
                           ELSE 100  
                           END) / COUNT(DISTINCT Visitors.VisitorID),  
                           2), ' AED') AS RevenuePerVisitor  
FROM Pavilions  
JOIN Visitors ON FIND_IN_SET(Pavilions.Name,  
                             Visitors.VisitedPavilions) > 0  
GROUP BY Pavilions.Name  
ORDER BY RevenuePerVisitor DESC  
LIMIT 1;
```

Rank Pavilions by Visitor Engagement Weighted by Revenue

Purpose

Calculates a Weighted Engagement Score by assigning weights to the number of events and the revenue generated for each pavilion. Useful for ranking pavilions based on combined performance metrics that factor in both activity levels and financial success.

Mathematical Notation

$$\text{Rank}(\pi_{\text{EngagementScore}} \left(w_1 \cdot \sum(\text{Events}) + w_2 \cdot \sum(\text{Revenue}) \right))$$

PavilionName
varchar

WeightedEngagementScore
varchar

Germany Pavilion

2,444,720.60 AED

USA Pavilion

2,417,840.60 AED

France Pavilion

2,403,520.60 AED

India Pavilion

2,402,520.60 AED

Saudi Arabia Pavilion

2,401,520.60 AED

Query

```
SELECT Pavilions.Name AS PavilionName,
       CONCAT(FORMAT((COUNT(DISTINCT
Events.EventID) * 0.6) +
(SUM(CASE
WHEN Visitors.TicketType = 'VIP' THEN 500
ELSE 100
END) * 0.4), 2), ' AED') AS
WeightedEngagementScore
FROM Pavilions
LEFT JOIN Events ON Pavilions.PavilionID =
Events.AssociatedPavilion
LEFT JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0
GROUP BY Pavilions.Name
ORDER BY WeightedEngagementScore DESC
LIMIT 5;
```

Calculate Pavilion Contribution to Total Footfall as a Percentage

Purpose

Calculates the percentage contribution of each pavilion to the total visitor count across all pavilions. Useful for identifying the most visited pavilions relative to others.

	PavilionName varchar	ContributionPercent varchar
UK Pavilion		9.85
Japan Pavilion		9.49
Saudi Arabia Pavilion		9.12
Italy Pavilion		8.76
Australia Pavilion		8.03

Mathematical Notation

$$\pi_{\text{PavilionName}, \text{ContributionPercent}} \left(\frac{\sum(\text{PavilionVisitors})}{\sum(\text{TotalVisitors})} \cdot 100 \right)$$

Query

```
SELECT Pavilions.Name AS PavilionName,  
       FORMAT((SUM(Pavilions.VisitorCount) /  
              (SELECT SUM(VisitorCount) FROM Pavilions))  
              * 100, 2) AS ContributionPercent  
  FROM Pavilions  
 GROUP BY Pavilions.Name  
 ORDER BY ContributionPercent DESC;
```

Complex Mathematical Notations

Unraveling Advanced Insights with Multi-Level Operations

Calculate the Pavilion Efficiency Index (PEI)

Purpose

This query calculates the Pavilion Efficiency Index (PEI), which evaluates how efficiently a pavilion generates revenue relative to its engagement score (events + exhibits). Useful for determining which pavilions optimize both visitor activity and revenue generation.

Mathematical Notation

$$\pi_{\text{PavilionName}, \text{PEI}} \left(\frac{\sum(\text{Revenue})}{\sum(\text{EngagementScore})} \right)$$

PavilionName	PavilionEfficiencyIndex
--------------	-------------------------

Germany Pavilion	6,111,800.00 AED
------------------	------------------

USA Pavilion	6,044,600.00 AED
--------------	------------------

France Pavilion	6,008,800.00 AED
-----------------	------------------

India Pavilion	6,006,300.00 AED
----------------	------------------

Saudi Arabia Pavilion	6,003,800.00 AED
-----------------------	------------------

Query

```
SELECT Pavilions.Name AS PavilionName,
       CONCAT(FORMAT(SUM(CASE
                           WHEN Visitors.TicketType = 'VIP' THEN 500
                           ELSE 100
                         END) /
                     ((COUNT(DISTINCT Events.EventID) * 0.6) +
                      (COUNT(DISTINCT Exhibits.ExhibitID) * 0.4)),
                     2), ' AED') AS PavilionEfficiencyIndex
  FROM Pavilions
  LEFT JOIN Events ON Pavilions.PavilionID =
    Events.AssociatedPavilion
  LEFT JOIN Exhibits ON Pavilions.PavilionID =
    Exhibits.PavilionHosted
  LEFT JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
                                     Visitors.VisitedPavilions) > 0
 GROUP BY Pavilions.Name
 ORDER BY PavilionEfficiencyIndex DESC
 LIMIT 5;
```

Find Pavilion with the Highest Revenue Contribution to Total Expo Revenue

Purpose

Calculates each pavilion's percentage contribution to the total Expo revenue. Useful for identifying which pavilion generates the most financial impact for the event.

Mathematical Notation

$$\pi_{\text{PavilionName}, \text{RevenueContributionPercent}} \left(\frac{\sum(\text{PavilionRevenue})}{\sum(\text{TotalRevenue})} \cdot 100 \right)$$

PavilionName	varchar
Italy Pavilion	

RevenueContributionPercent	varchar
9.94 %	

Query

```
SELECT Pavilions.Name AS PavilionName,
       CONCAT(FORMAT((SUM(CASE
                           WHEN Visitors.TicketType = 'VIP' THEN 500
                           ELSE 100
                         END) /
                      (SELECT SUM(CASE
                               WHEN Visitors.TicketType = 'VIP' THEN
                                   500
                               ELSE 100
                             END)
                      FROM Visitors)) * 100, 2), ' %') AS
       RevenueContributionPercent
  FROM Pavilions
 LEFT JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
                                     Visitors.VisitedPavilions) > 0
 GROUP BY Pavilions.Name
 ORDER BY RevenueContributionPercent DESC
 LIMIT 1;
```

Determine Visitor Engagement Weighted by Feedback Quality

Purpose

Combines the number of events and exhibits with the average feedback length to calculate Weighted Engagement. Useful for analyzing how visitor feedback correlates with pavilion activity levels.

Mathematical Notation

$$\pi_{\text{PavilionName}, \text{WeightedEngagement}} \left(\sum (\text{Events} + \text{Exhibits}) \cdot \bar{F} \right)$$

PavilionName varchar	WeightedEngagement varchar
Australia Pavilion	73.81 Points
UAE Pavilion	73.74 Points
India Pavilion	73.64 Points
USA Pavilion	73.62 Points
UK Pavilion	73.61 Points

Query

```
SELECT Pavilions.Name AS PavilionName,
       CONCAT(FORMAT(((COUNT(DISTINCT
Events.EventID) +
                  COUNT(DISTINCT Exhibits.ExhibitID)) *
                  AVG(LENGTH(Visitors.Feedback))), 2), ' Points')
AS WeightedEngagement
FROM Pavilions
LEFT JOIN Events ON Pavilions.PavilionID =
Events.AssociatedPavilion
LEFT JOIN Exhibits ON Pavilions.PavilionID =
Exhibits.PavilionHosted
LEFT JOIN Visitors ON FIND_IN_SET(Pavilions.Name,
Visitors.VisitedPavilions) > 0
GROUP BY Pavilions.Name
ORDER BY WeightedEngagement DESC
LIMIT 5;
```

Key Takeaways

- **Comprehensive Analysis**
 - The Expo 2020 database allows us to analyze financial performance, visitor engagement, and operational efficiency at a granular level.
- **Actionable Insights:**
 - Queries help identify high-performing pavilions, optimize resource allocation, and improve visitor experiences.
- **Advanced Techniques**
 - Combining SQL with mathematical notations enables complex, data-driven decision-making.

Conclusion

References

1

Database Concepts

Fundamentals of Database Systems (Elmasri & Navathe, 7th Edition)

2

SQL Techniques

W3Schools SQL Tutorial: <https://www.w3schools.com/sql/>

3

Mathematical Notations

Relational Algebra and SQL Equivalences (Codd, 1970)

Database Management System Notes: <https://dbms-notes.com>

4

Expo 2020 Context

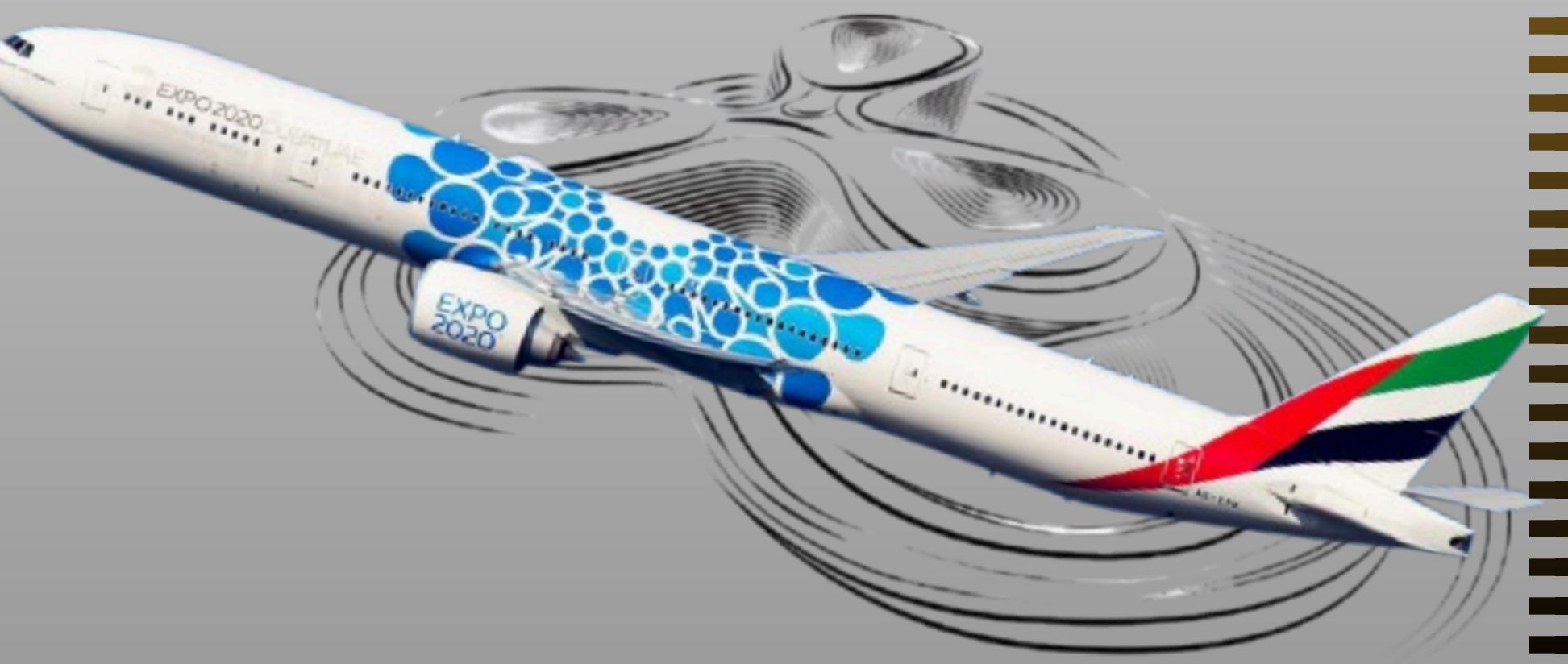
Expo 2020 Dubai Official Website: <https://www.expo2020dubai.com/>

Reports and Archives: Expo 2020 Official Documents (**Source chose to remain unidentified**)

5

Python for Data Generation

Faker Library Documentation: <https://faker.readthedocs.io>





Thank You!

This is still just the beginning of something big.

Made By: Umair Dada

CS 457 - Vidhyacharan Bhaskar

