Art Gallery Project

University:
Baruch College – Zicklin School of Business

Course Name and Number:
CIS 9340: Principles of Database Management Systems

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Student Name(s):
Kaiyu Lin

Thanh Huong Tra Nguyen

Fei Jiang

Lu Chen

Instructor's Name:
Edsn Kensington

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1.Business Senario

We have run an art gallery for years, and we have held 4 activities. There will be 2 more galleries in the foreseen future. In the past 4 activities, We have been using spreadsheets and a paper to record all the staff, artwork and all the other information, and now we are making the transition to a more sophisticated database management.

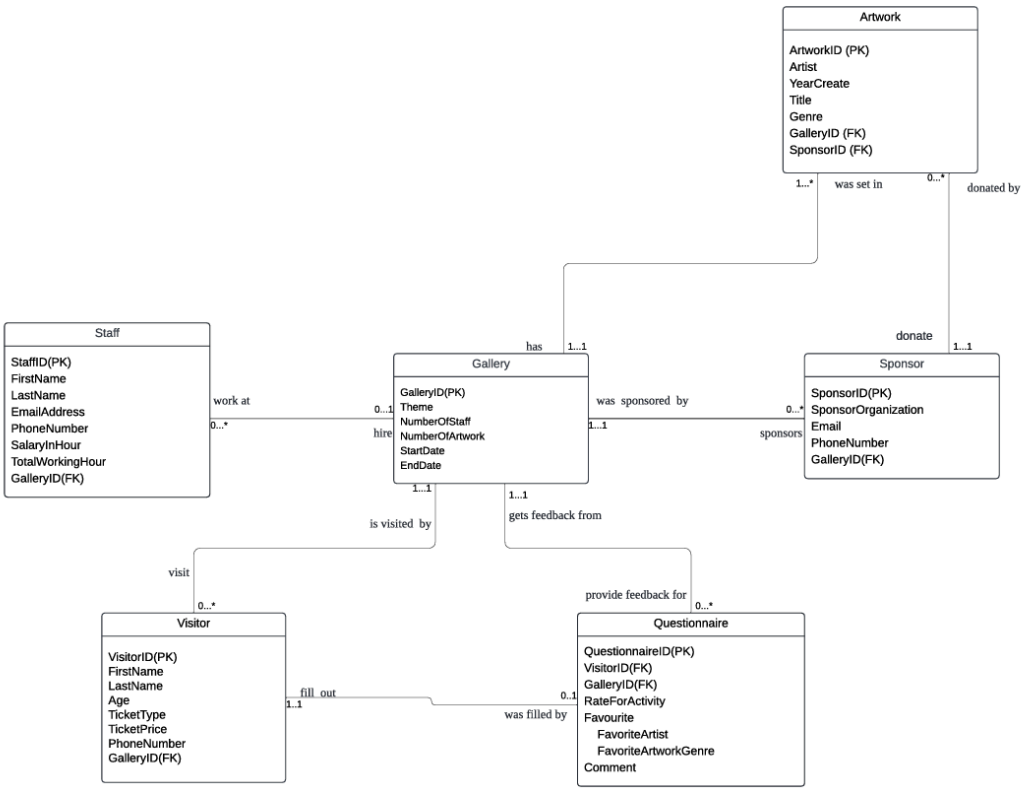
The art galleries we have held are dedicated to showcasing a diverse range of themes, including "Humans and the Environment," "Heroes and Leaders," "Eclectic Expressions: A Fusion of Styles," "Nature's Palette: Art Inspired by the Environment," "Urban Rhythms: Exploring City Life Through Art," and "Beyond Boundaries: International Art Extravaganza." While Gallery 5 and Gallery 6 are planned for future operation, our primary focus for now is on improving the activities of Gallery 1, Gallery 2, Gallery 3, and Gallery 4. This strategic approach involves iterative enhancements and data-driven improvements that will benefit all galleries in the long term.

We will delve into systems analysis and entity-relationship (E-R) modeling, followed by logical modeling and normalization, to ensure an efficient and optimal database structure. Moreover, we will provide insights into the implementation of a physical database using SQL, allowing for an in-depth examination of various aspects, including exhibition trends, visitor preferences, and financial performance across the active galleries.

Key areas of focus that we will encompass are the representation of artworks spanning different centuries, promoting diversity in artists and genres, understanding visitor preferences, highlighting renowned artists, and assessing financial metrics such as revenue, expenses, and response rates. To extract meaningful insights, we will utilize SQL queries and employ visual aids to facilitate a comprehensive understanding of the data.

Our findings will mainly focus on the result of gallery 1 & 2, providing valuable guidance for future strategic decisions. From the abundance of artworks to visitor demographics and financial performance, we aim to offer actionable recommendations to enhance the overall gallery experience and ensure sustained success as we prepare for the future operation of Gallery 5 and Gallery 6.

2. ER Modeling using UML Notation



3. Conversion to Relational Model

We have created six entities. The relational model is listed below.

Entity 1:**Staff**

Staff(StaffID, FirstName, LastName, EmailAddress, PhoneNumber, SalaryInHour, TotalWorkingHour, GalleryID(fk))

Relationship sentence: One staff can work for zero to one gallery.

One gallery may hire zero to many staff.

Entity 2: **Gallery**

Galley(GalleryID, Theme, NumberOfStaff, NumberOfArtwork, StartDate, EndDate)

Relationship sentence: One gallery can be sponsored by zero to many sponsors.

One sponsor can sponsor one and only one gallery.

Entities 3: **Artwork**

Artwork(ArtworkID, Artist, YearCreate, Title, Genre, GalleryID(fk), SponsorID(fk))

Relationship: One gallery can have one to many artwork.

One artwork must be sent in one and only one gallery.

One artwork must be sponsored by one and only one sponsor.

One sponsor can sponsor one to many artworks.

Entities 4: **Sponsor**

Sponsor(SponsorID, SponsorOrganization, Email, PhoneNumber, GalleryID(fk))

Relationship sentence: One artwork must be donated by one and only one sponsor.

One sponsor may donate zero to many artworks.

Entities 5: **Visitor**

Visitor(VisitorID,FirstName,LastName,IdentityID,Age,TicketType,TicketPrice,PhoneNumber, GalleryID(fk))

Relationship sentence: One visitor can visit zero to many galleries.

One gallery can be visited by only one visitor

Entity 6: **Questionnaire**

Questionnaire(QuestionnaireID, VisitorID(fk), GalleryID(fk), RateForActivity, FavoriteArtist, FavoriteArtworkGenre, Comment)

Relationship sentence: One visitor can fill out zero to one questionnaire.

One questionnaire must be filled by one and only one visitor.

One questionnaire can be associated with one and only one gallery

One gallery can have zero to many questionnaires

3. Normalization

Sponsor (SponsorID, Sponsor Organization, Email, PhoneNumber, GalleryID)

- Already in 1NF because are no repeating values and all are atomic
- All are functionally dependent on SponsorID -> table in 2NF
- No transitive dependencies in this table -> table in 3NF

Staff, Galley, Questionnaire are the same as Sponsor, and they are already in the third normal form.

Only Visitor and Artwork do not in the third normal form.

Visitor(VisitorID, FirstName, LastName, IdentityID, Age, TicketType, TicketPrice, PhoneNumber, GalleryID)

Key: VisitorID

FD1: VisitorID -> FirstName, LastName, IdentityID, Age, TicketType, TicketPrice, PhoneNumber, GalleryID

FD2: Age -> TicketPrice, TicketType

	A	B	C	D	E	F	G	H
1	VisitorID	FirstName	LastName	Age	TicketType	TicketPrice	PhoneNumber	GalleryID
2	1	Conor	Drake	24	adult	30	7186949569	1
3	2	Herbert	Mcmillan	35	adult	30	6466322999	1
4	3	Cordelia	Preston	12	child	15	6466322999	1
5	4	Savannah	Hayden	10	child	15	6466322999	1
6	5	Jasper	Bridges	33	adult	30	9179454323	1
7	6	Catrin	George	53	adult	30	8458429596	1
8	7	Aamina	Case	9	child	15	8458429596	1
9	8	Lexi	Harrington	34	adult	30	5162332150	1
10	9	Rahim	Roy	67	elder	15	6318540173	1
11	10	Jonathan	Fleming	45	adult	30	2123798708	1
12	11	Anna	Michaek	30	adult	30	9175654756	1
13	12	Marshall	Valentine	20	adult	30	9155687956	1
14	13	Ross	Anderson	13	child	15	5156965562	1
15	14	Pearl	Mcmahon	15	child	15	5165899634	1
16	15	Sara	Shepherd	45	adult	30	9295648895	2
17	16	Sienna	Gomez	65	elder	15	3475648964	2
18	17	Dewey	Sherman	70	elder	15	9175648963	2
19	18	Elena	Garner	71	elder	15	9294568706	2
20	19	Ayesha	Ford	68	elder	15	917568417	2
21	20	Enzo	Elliott	34	adult	30	3475681239	2
22	21	Shayla	Banks	23	adult	30	8455012783	2
23	22	Lucian	Estes	36	adult	30	6468215723	2
24	23	Carlos	Burke	16	child	15	6466865330	2
25	24	Ameer	Benton	32	adult	30	8457010168	2
26	25	Cassius	Monroe	28	adult	30	5185394915	2
27	26	Husna	Martin	26	adult	30	3156188127	2
28	27	Carys	Fox	45	adult	30	5162217333	2
29	28	Neve	Stafford	76	elder	15	6314436752	2
30	29	Ronan	Burch	65	elder	15	5858201905	2
31	30	Yusra	May	27	adult	30	3154269711	2
32	31	Han	Lu	14	child	15	9902047777	2
33	32	Willis	Oh	17	child	15	9941249494	2
34	33	Suho	Kim	32	adult	30	9912251111	2
35	34	Wonwoo	Jeon	27	adult	30	9961776666	2
36	35	Joshua	Hong	72	elder	15	9953333012	2

Staff | Gallery | Artwork | Sponsor | Visitor | Ticket | Questionnaire

In the Visitor table, there is a transitive dependency, FD2, so we can pull it out and make it in the third normal form.

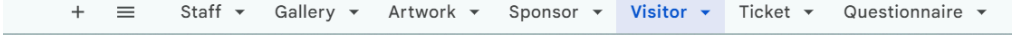
New tables would be the Visitor table and the Ticket table.

Visitor(VisitorID, FirstName, LastName, IdentityID, PhoneNumber, GalleryID)

Key: VisitorID

FD1: VisitorID -> FirstName, LastName, IdentityID, PhoneNumber, GalleryID

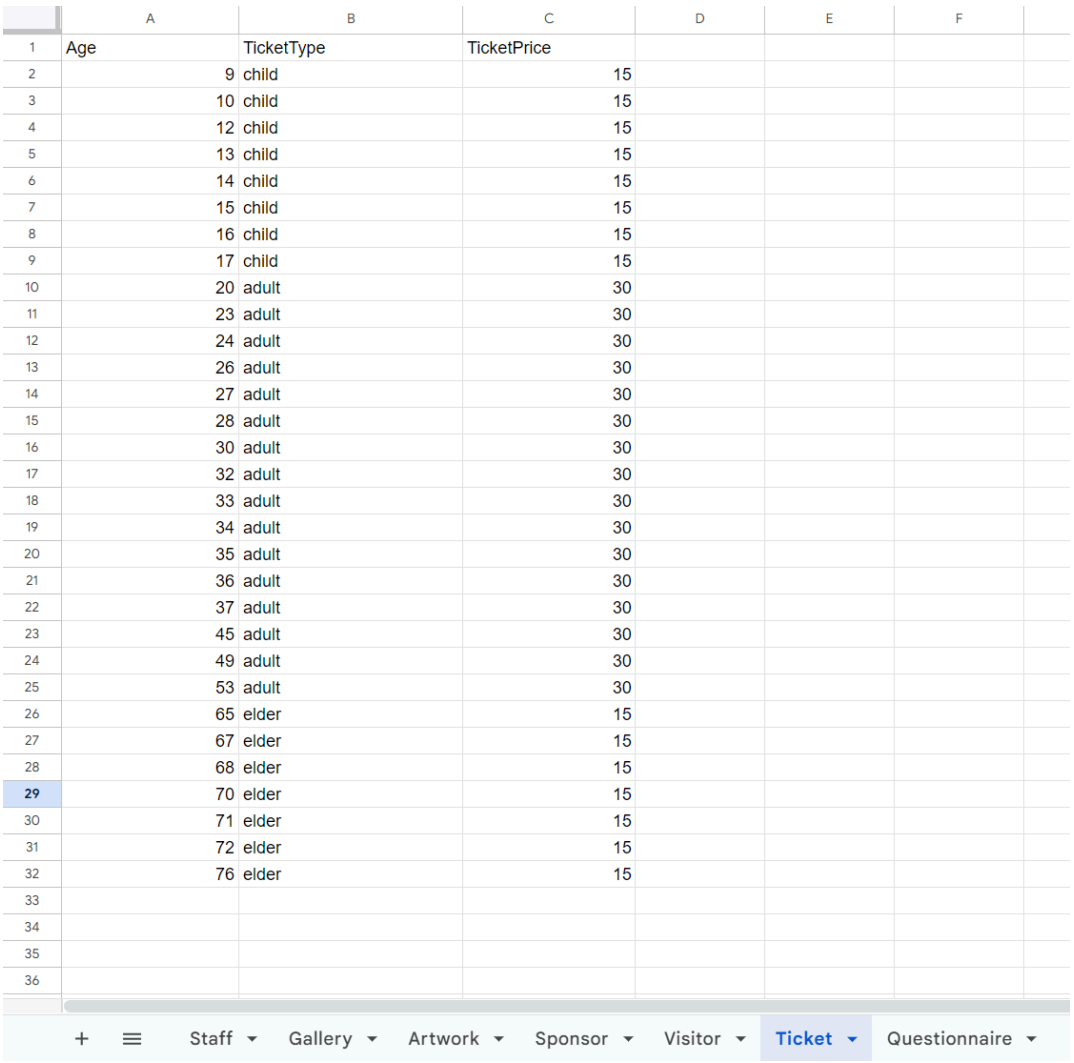
	A	B	C	D	E	F	G
1	VisitorID	FirstName	LastName	Age	PhoneNumber	GalleryID	
2	1	Conor	Drake	24	7186949569	1	
3	2	Herbert	Mcmillan	35	6466322999	1	
4	3	Cordelia	Preston	12	6466322999	1	
5	4	Savannah	Hayden	10	6466322999	1	
6	5	Jasper	Bridges	33	9179454323	1	
7	6	Catrin	George	53	8458429596	1	
8	7	Aamina	Case	9	8458429596	1	
9	8	Lexi	Harrington	34	5162332150	1	
10	9	Rahim	Roy	67	6318540173	1	
11	10	Jonathan	Fleming	45	2123798708	1	
12	11	Anna	Michaek	30	9175654756	1	
13	12	Marshall	Valentine	20	9155687956	1	
14	13	Ross	Anderson	13	5156965562	1	
15	14	Pearl	Mcmahon	15	5165899634	1	
16	15	Sara	Shepherd	45	9295648895	2	
17	16	Sienna	Gomez	65	3475648964	2	
18	17	Dewey	Sherman	70	9175648963	2	
19	18	Elena	Garner	71	9294568706	2	
20	19	Ayesha	Ford	68	917568417	2	
21	20	Enzo	Elliott	34	3475681239	2	
22	21	Shayla	Banks	23	8455012783	2	
23	22	Lucian	Estes	36	6468215723	2	
24	23	Carlos	Burke	16	6466865330	2	
25	24	Ameer	Benton	32	8457010168	2	
26	25	Cassius	Monroe	28	5185394915	2	
27	26	Husna	Martin	26	3156188127	2	
28	27	Carys	Fox	45	5162217333	2	
29	28	Neve	Stafford	76	6314436752	2	
30	29	Ronan	Burch	65	5858201905	2	
31	30	Yusra	May	27	3154269711	2	
32	31	Han	Lu	14	9902047777	2	
33	32	Willis	Oh	17	9941249494	2	
34	33	Suho	Kim	32	9912251111	2	
35	34	Wonwoo	Jeon	27	9961776666	2	
36	35	Joshua	Hong	72	9953333012	2	



Ticket(Age, TicketType, TicketPrice)

Key: Age

FD1: Age -> TicketPrice, TicketType



	A	B	C	D	E	F
1	Age	TicketType	TicketPrice			
2	9	child	15			
3	10	child	15			
4	12	child	15			
5	13	child	15			
6	14	child	15			
7	15	child	15			
8	16	child	15			
9	17	child	15			
10	20	adult	30			
11	23	adult	30			
12	24	adult	30			
13	26	adult	30			
14	27	adult	30			
15	28	adult	30			
16	30	adult	30			
17	32	adult	30			
18	33	adult	30			
19	34	adult	30			
20	35	adult	30			
21	36	adult	30			
22	37	adult	30			
23	45	adult	30			
24	49	adult	30			
25	53	adult	30			
26	65	elder	15			
27	67	elder	15			
28	68	elder	15			
29	70	elder	15			
30	71	elder	15			
31	72	elder	15			
32	76	elder	15			
33						
34						
35						
36						

In this way, the Visitor table is in the third normal form.

Artwork(ArtworkID, Artist, Year Create, Title, Genre, GalleryID, SponsorID)
Key: ArtworkID
FD1: ArtworkID -> Artist, Year Create, Title, Genre, GalleryID, SponsorID
FD2: SponsorID -> GalleryID

F3 | 1

	A	B	C	D	E	F	G
1	ArtworkID	Artist	YearCreate	Title	Genre	GalleryID	SponsorID
2	1	Thomas Jackson	2021	*Chaotic Equilibrium*	Modern	1	1
3	2	Omar Abulsheikh	2022	*Spooky Kingdom*	Abstract	1	1
4	3	Omar Abulsheikh	2022	*Lord*	Abstract	1	1
5	4	Omar Abulsheikh	2022	*King Omar 2*	Abstract	1	1
6	5	Omar Abulsheikh	2021	*Superland*	Abstract	1	1
7	6	Aaron Kleeblatt	2023	*Jonny O*	Painting	1	1
8	7	Aaron Kleeblatt	2023	*Mike Myers*	Painting	1	1
9	8	Aaron Kleeblatt	2022	*I Must Break You*	Painting	1	2
10	9	Hubert Posey	2018	*Untitled*	Installation	1	2
11	10	Hubert Posey	2019	*Untitled*	Installation	1	2
12	11	Pierre-Auguste Renoir	1881	*The Basket of Oranges*	Impressionism	1	2
13	12	Pierre-Auguste Renoir	1876	*Dance at Le Moulin de la Galette*	Impressionism	1	2
14	13	Pierre-Auguste Renoir	1886	*The Umbrellas*	Impressionism	1	2
15	14	Yayoi Kusama	2008	*Shooting Star*	Installation	1	2
16	15	Yayoi Kusama	2002	*Obliteration Room*	Contemporary	1	2
17	16	Olafur Eliasson	2010	*Tree of Codes*	Contemporary	2	3
18	17	Olafur Eliasson	2003	*The Weather Project*	Contemporary	2	3
19	18	Olafur Eliasson	2014	*Riverbed*	Contemporary	2	3
20	19	Banksy	2002	*Girl with a Red Balloon*	Contemporary	2	3
21	20	Banksy	2002	*There Is Always Hope*	Contemporary	2	3
22	21	Ellsworth Kelly	1951	*Colors for a Large Wall*	Abstract	2	3
23	22	Kazimir Malevich	1915	*Black Square*	Abstract	2	3
24	23	Frank Stella	1959	*Die Fahne Hoch!*	Abstract	2	3
25	24	Julian Schnabel	1988	*The Patients and the Doctors*	Abstract	2	3
26	25	Thomas Eakins	1875	*The Gross Clinic*	realism	2	3
27	26	Winslow Homer	1899	*The Gulf Stream*	realism	2	4
28	27	Édouard Manet	1863	*Olympia*	realism	2	4
29	28	Camille Pissarro	1871	*The Avenue, Sydenham*	Impressionism	2	4
30	29	Andrew Wyeth	1948	*Christina's World*	Impressionism	2	4
31	30	Joaquín Sorolla	1909	*Walk on the Beach*	Impressionism	2	4
32	31	Gilbert Stuart	1826	*John Adams*	Painting	2	4
33	32	Ralph Eleaser Whiteside Earl	1836	*Andrew Jackson*	Painting	2	4
34	33	Ferdinand Pettrich	1856	*The Dying Tecumseh*	Historical	2	4
35	34	Ferdinand Pettrich	1841	*Washington Resigning His Commission*	Historical	2	4
36	35	Daniel Chester French	1889	*Concord Minute Man of 1775*	Historical	2	4

Staff | Gallery | Artwork | Sponsor | Visitor | Ticket | Questionnaire

In the Artwork table, there is a transitive dependency, FD2, so we can pull it out and make it in the third normal form. However, SponsorID and GalleryID have already been included in the Sponsor table, as well as their dependency.

A1 | SponsorID

	A	B	C	D	E
1	SponsorID	SponsorOrganization	Email	PhoneNumber	GalleryID
2	1	School of Visual Arts	bfaadvdes@sva.edu	2125922160	1
3	2	Ford Foundation	fordfoundation@gov.com	5158965104	1
4	3	Getty Foundation	Getty1foundation@gov.com	9175654485	2
5	4	Guggenheim Foundation	Guggenheim34@gov.com	6465987063	2

Staff | Gallery | Artwork | Sponsor | Visitor | Ticket | Questionnaire

Therefore, we can just delete GalleryID in this table.

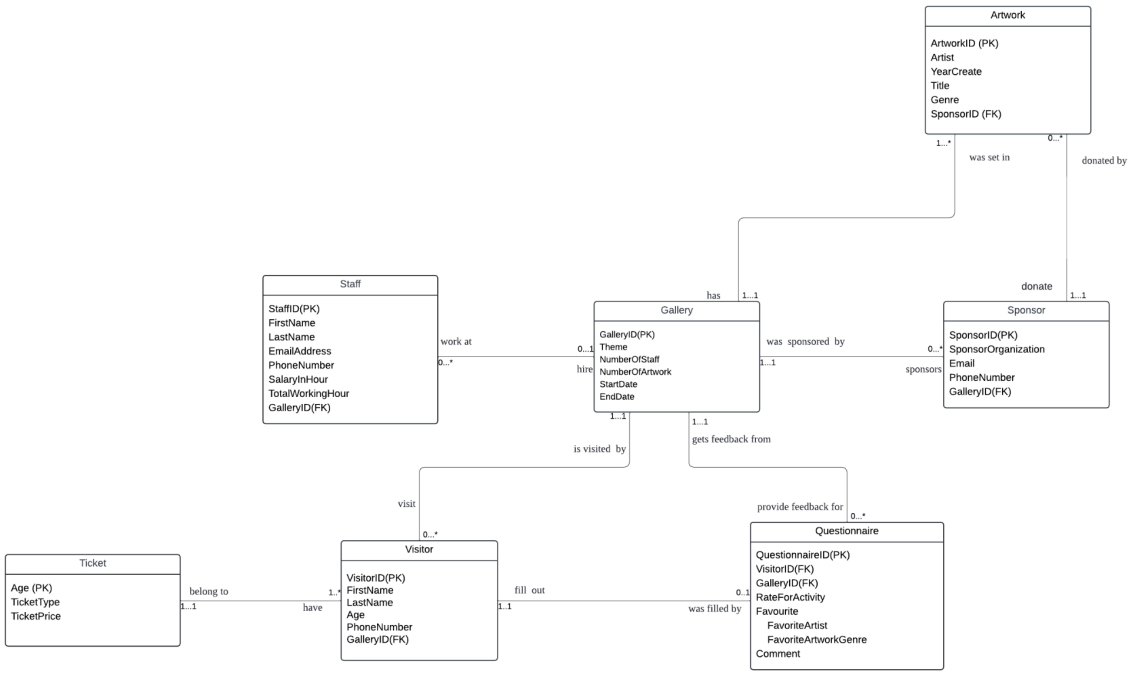
F1 | SponsorID

	A	B	C	D	E	F
1	ArtworkID	Artist	YearCreate	Title	Genre	SponsorID
2	1	Thomas Jackson	2021	*Chaotic Equilibrium*	Modern	1
3	2	Omar Abulsheikh	2022	*Spooky Kingdom*	Abstract	1
4	3	Omar Abulsheikh	2022	*Lord*	Abstract	1
5	4	Omar Abulsheikh	2022	*King Omar 2*	Abstract	1
6	5	Omar Abulsheikh	2021	*Superland*	Abstract	1
7	6	Aaron Kleeblatt	2023	*Jonny O*	Painting	1
8	7	Aaron Kleeblatt	2023	*Mike Myers*	Painting	1
9	8	Aaron Kleeblatt	2022	*I Must Break You*	Painting	2
10	9	Hubert Posey	2018	*Untitled*	Installation	2
11	10	Hubert Posey	2019	*Untitled*	Installation	2
12	11	Pierre-Auguste Renoir	1881	*The Basket of Oranges*	Impressionism	2
13	12	Pierre-Auguste Renoir	1876	*Dance at Le Moulin de la Galette*	Impressionism	2
14	13	Pierre-Auguste Renoir	1886	*The Umbrellas*	Impressionism	2
15	14	Yayoi Kusama	2008	*Shooting Star*	Installation	2
16	15	Yayoi Kusama	2002	*Obliteration Room*	Contemporary	2
17	16	Olafur Eliasson	2010	*Tree of Codes*	Contemporary	3
18	17	Olafur Eliasson	2003	*The Weather Project*	Contemporary	3
19	18	Olafur Eliasson	2014	*Riverbed*	Contemporary	3
20	19	Banksy	2002	*Girl with a Red Balloon*	Contemporary	3
21	20	Banksy	2002	*There Is Always Hope*	Contemporary	3
22	21	Ellsworth Kelly	1951	*Colors for a Large Wall*	Abstract	3
23	22	Kazimir Malevich	1915	*Black Square*	Abstract	3
24	23	Frank Stella	1959	*Die Fahne Hoch!*	Abstract	3
25	24	Julian Schnabel	1988	*The Patients and the Doctors*	Abstract	3
26	25	Thomas Eakins	1875	*The Gross Clinic*	realism	3
27	26	Winslow Homer	1899	*The Gulf Stream*	realism	4
28	27	Édouard Manet	1863	*Olympia*	realism	4
29	28	Camille Pissarro	1871	*The Avenue, Sydenham*	Impressionism	4
30	29	Andrew Wyeth	1948	*Christina's World*	Impressionism	4
31	30	Joaquín Sorolla	1909	*Walk on the Beach*	Impressionism	4
32	31	Gilbert Stuart	1826	*John Adams*	Painting	4
33	32	Ralph Eleaser Whiteside Earl	1836	*Andrew Jackson*	Painting	4
34	33	Ferdinand Pettrich	1856	*The Dying Tecumseh*	Historical	4
35	34	Ferdinand Pettrich	1841	*Washington Resigning His Commission*	Historical	4
36	35	Daniel Chester French	1889	*Concord Minute Man of 1775*	Historical	4

Staff | Gallery | Artwork | Sponsor | Visitor | Ticket | Questionnaire

The Artwork table is in the third normal form.

Here is the updated ER Diagram after Normalization



Entity 7: Ticket

Ticket(Age, TicketType, TicketPrice)

Relationship sentence: One visitor can have one to many tickets.

One ticket belongs to one and only one visitor

4. Creating the Database Schema with SQL

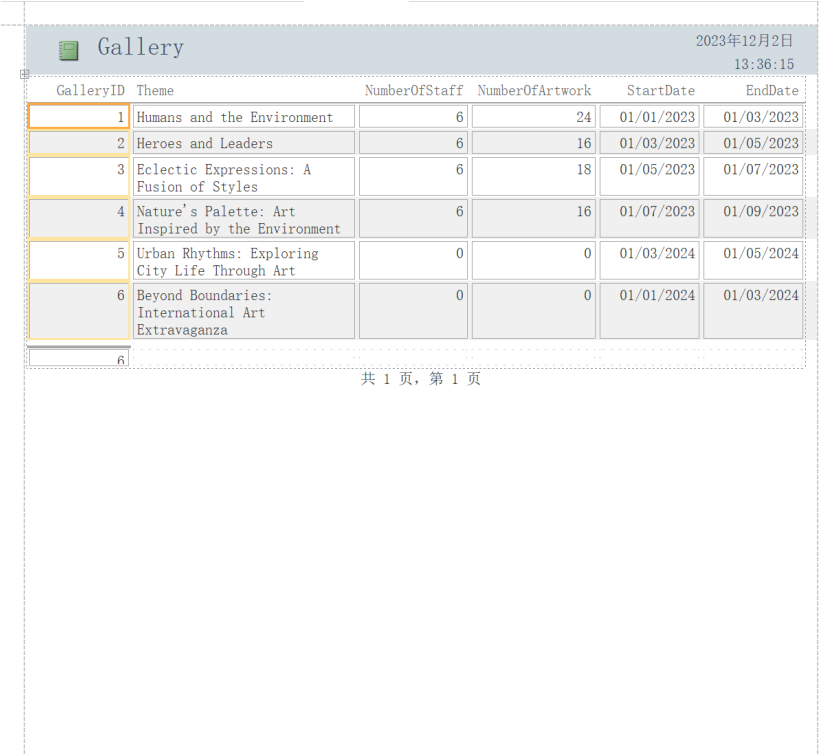
```
CREATE TABLE Staff (
    StaffID INT PRIMARY KEY,
    FirstName VARCHAR(50),
    LastName VARCHAR(50),
    EmailAddress VARCHAR(100),
    PhoneNumber VARCHAR(15),
    SalaryInHour DECIMAL(10, 2),
    TotalWorkingHour INT,
    GalleryID INT,
    FOREIGN KEY (GalleryID) REFERENCES Gallery(GalleryID)
);
```

Staff

2023年12月2日 13:35:33

StaffID	FirstName	LastName	EmailAddress	PhoneNumber	SalaryInHour	TotalWorkingHour
1	Dafydd	Matthews	dafyddmatthews@gmai.com	5852067867	15	120
2	Eryn	Hatfield	erynhatfield@gmail.com	8452843797	15	120
3	Serena	Ponce	serenaponce@gmail.com	3476430823	20	130
4	Joser	Rosario	joserosario@gmail.com	9173928533	20	125
5	Nieve	Winters	nievewinters@gmail.com	3475635587	15	125
6	Sadie	Santana	sadiesantana@gmail.com	9295647789	15	140
7	Iwan	Fletcher	Iwanfletcher@gmail.com	3475657894	25	150
8	Steve	Gamble	stevegamble@gmail.com	9295645677	25	145
9	Trinity	Fox	TrinityFox@gmail.com	5168957461	20	135
10	Juliet	Hooper	JulietHooper@gmail.com	3475689778	20	150
11	Alisha	Stanton	AlishaStanton@gmail.com	5167895546	20	155
12	Teddy	Gray	TeddyGray@gmail.com	9175648893	15	135
13	Dafydd	Matthews	dafyddmatthews@gmai.com	5852067867	15	110
14	Eryn	Hatfield	erynhatfield@gmail.com	8452843797	15	120
15	Serena	Ponce	serenaponce@gmail.com	3476430823	20	140
16	Joser	Rosario	joserosario@gmail.com	9173928533	20	125
17	Nieve	Winters	nievewinters@gmail.com	3475635587	15	160
18	Sadie	Santana	sadiesantana@gmail.com	9295647789	15	140
19	Iwan	Fletcher	Iwanfletcher@gmail.com	3475657894	25	115
20	Steve	Gamble	stevegamble@gmail.com	9295645677	25	145
21	Trinity	Fox	TrinityFox@gmail.com	5168957461	20	120
22	Juliet	Hooper	JulietHooper@gmail.com	3475689778	20	150
23	Alisha	Stanton	AlishaStanton@gmail.com	5167895546	20	140
24	Teddy	Gray	TeddyGray@gmail.com	9175648893	15	110

```
CREATE TABLE Gallery (
    GalleryID INT PRIMARY KEY,
    Theme VARCHAR(100),
    NumberOfStaff INT,
    NumberOfArtwork INT,
    StartDate DATE,
    EndDate DATE
);
```



Gallery

2023年12月2日 13:36:15

GalleryID	Theme	NumberOfStaff	NumberOfArtwork	StartDate	EndDate
1	Humans and the Environment	6	24	01/01/2023	01/03/2023
2	Heroes and Leaders	6	16	01/03/2023	01/05/2023
3	Eclectic Expressions: A Fusion of Styles	6	18	01/05/2023	01/07/2023
4	Nature's Palette: Art Inspired by the Environment	6	16	01/07/2023	01/09/2023
5	Urban Rhythms: Exploring City Life Through Art	0	0	01/03/2024	01/05/2024
6	Beyond Boundaries: International Art Extravaganza	0	0	01/01/2024	01/03/2024

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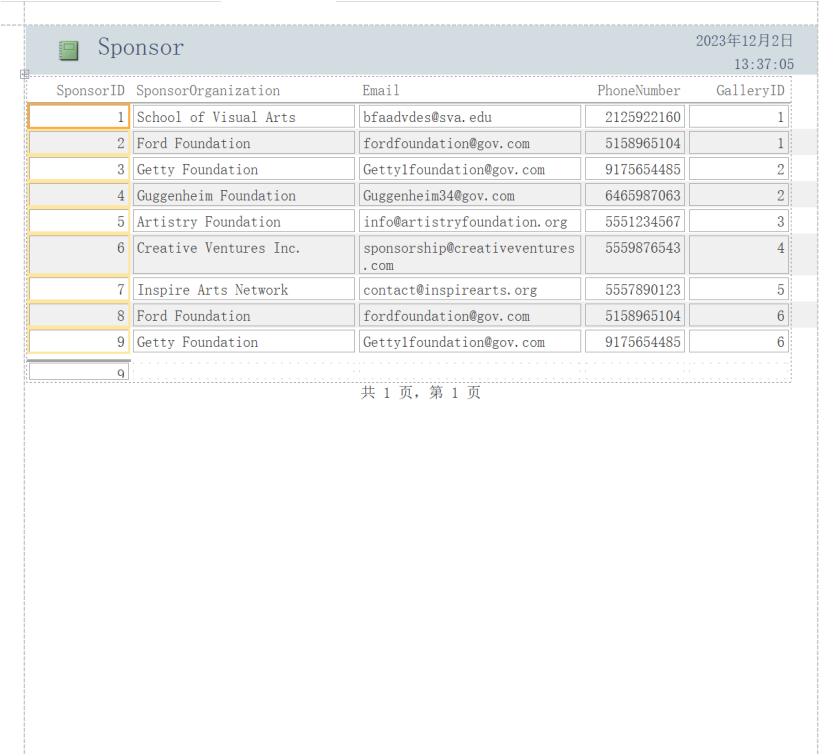
```
CREATE TABLE Artwork (
    ArtworkID INT PRIMARY KEY,
    Artist VARCHAR(50),
    YearCreate INT,
    Title VARCHAR(100),
    Genre VARCHAR(50),
    GalleryID INT,
    SponsorID INT,
    FOREIGN KEY (SponsorID) REFERENCES Sponsor(SponsorID)
);
```

Artwork

2023年12月2日 13:36:39

ArtworkID	Artist	YearCreate	Title	Genre	SponsorID
1	Thomas Jackson	2021	Chaotic Equilibrium	Modern	1
2	Omar Abulsheikh	2022	Spooky Kingdom	Abstract	1
3	Omar Abulsheikh	2022	Lord	Abstract	1
4	Omar Abulsheikh	2022	King Omar 2	Abstract	1
5	Omar Abulsheikh	2021	Superland	Abstract	1
6	Aaron Kleeblatt	2023	Jonny O	Painting	1
7	Aaron Kleeblatt	2023	Mike Myers	Painting	1
8	Aaron Kleeblatt	2022	I Must Break You	Painting	2
9	Hubert Posey	2018	Untitled	Installation	2
10	Hubert Posey	2019	Untitled	Installation	2
11	Pierre-Auguste Renoir	1881	The Basket of Oranges	Impressionism	2
12	Pierre-Auguste Renoir	1876	Dance at Le Moulin de la Galette	Impressionism	2
13	Pierre-Auguste Renoir	1886	The Umbrellas	Impressionism	2
14	Yayoi Kusama	2008	Shooting Star	Installation	2
15	Yayoi Kusama	2002	Obliteration Room	Contemporary	2
16	Olafur Eliasson	2010	Tree of Codes	Contemporary	3
17	Olafur Eliasson	2003	The Weather Project	Contemporary	3
18	Olafur Eliasson	2014	Riverbed	Contemporary	3
19	Banksy	2002	Girl with a Red Balloon	Contemporary	3
20	Banksy	2002	There Is Always Hope	Contemporary	3
21	Ellsworth Kelly	1951	Colors for a Large Wall	Abstract	3
22	Kazimir Malevich	1915	Black Square	Abstract	3
23	Frank Stella	1959	Die Fahne Hoch!	Abstract	3
24	Julian Schnabel	1988	The Patients and the Doctors	Abstract	3

```
CREATE TABLE Sponsor (
    SponsorID INT PRIMARY KEY,
    SponsorOrganization VARCHAR(100),
    Email VARCHAR(100),
    PhoneNumber VARCHAR(15),
    GalleryID INT,
    FOREIGN KEY (GalleryID) REFERENCES Gallery(GalleryID)
);
```



Sponsor

2023年12月2日 13:37:05

SponsorID	SponsorOrganization	Email	PhoneNumber	GalleryID
1	School of Visual Arts	bfaadvdes@sva.edu	2125922160	1
2	Ford Foundation	fordfoundation@gov.com	5158965104	1
3	Getty Foundation	Gettylfoundation@gov.com	9175654485	2
4	Guggenheim Foundation	Guggenheim34@gov.com	6465987063	2
5	Artistry Foundation	info@artistryfoundation.org	5551234567	3
6	Creative Ventures Inc.	sponsorship@creativeventures.com	5559876543	4
7	Inspire Arts Network	contact@inspirearts.org	5557890123	5
8	Ford Foundation	fordfoundation@gov.com	5158965104	6
9	Getty Foundation	Gettylfoundation@gov.com	9175654485	6
9				

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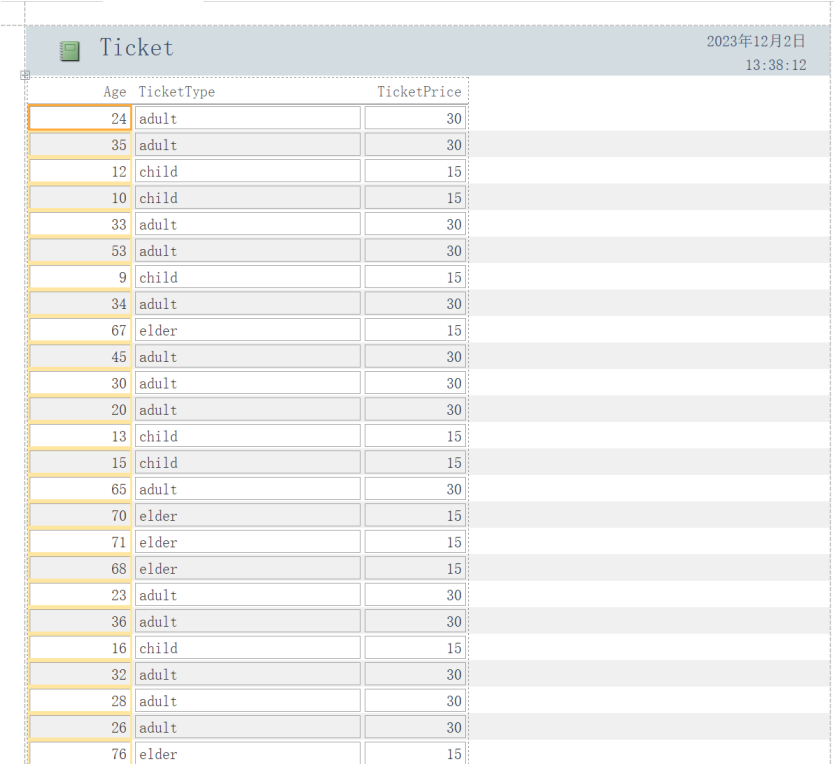
```
CREATE TABLE Visitor (
    VisitorID INT PRIMARY KEY,
    FirstName VARCHAR(50),
    LastName VARCHAR(50),
    IdentityID VARCHAR(20),
    Age INT,
    PhoneNumber VARCHAR(15),
    GalleryID INT,
    FOREIGN KEY (GalleryID) REFERENCES Gallery(GalleryID)
);
```

Visitor

2023年12月2日 13:37:29

VisitorID	FirstName	LastName	Age	PhoneNumber	GalleryID
1	Conor	Drake	24	7186949569	1
2	Herbert	Mcmillan	35	6466322999	1
3	Cordelia	Preston	12	6466322999	1
4	Savannah	Hayden	10	6466322999	1
5	Jasper	Bridges	33	9179454323	1
6	Catrin	George	53	8458429596	1
7	Aamina	Case	9	8458429596	1
8	Lexi	Harrington	34	5162332150	1
9	Rahim	Roy	67	6318540173	1
10	Jonathan	Fleming	45	2123798708	1
11	Anna	Michaek	30	9175654756	1
12	Marshall	Valentine	20	9155687956	1
13	Ross	Anderson	13	5156965562	1
14	Pearl	Mcmahon	15	5165899634	1
15	Sara	Shepherd	45	9295648895	2
16	Sienna	Gomez	65	3475648964	2
17	Dewey	Sherman	70	9175648963	2
18	Elena	Garner	71	9294568706	2
19	Ayesha	Ford	68	9175684170	2
20	Enzo	Elliott	34	3475681239	2
21	Shayla	Banks	23	8455012783	2
22	Lucian	Estes	36	6468215723	2
23	Carlos	Burke	16	6466865330	2
24	Ameer	Benton	32	8457010168	2

```
CREATE TABLE Ticket(
    Age INT,
    TicketType VARCHAR(50),
    TicketPrice DECIMAL(10, 2)
);
```



Ticket

2023年12月2日 13:38:12

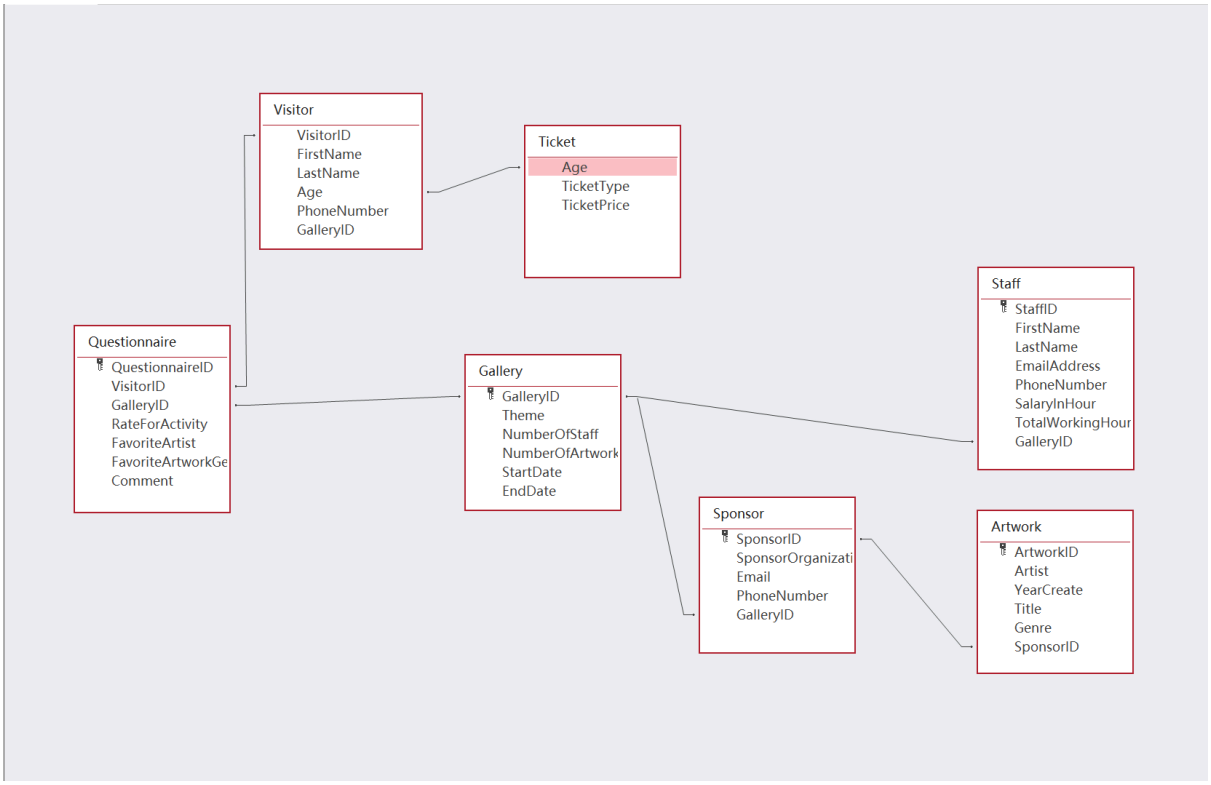
Age	TicketType	TicketPrice
24	adult	30
35	adult	30
12	child	15
10	child	15
33	adult	30
53	adult	30
9	child	15
34	adult	30
67	elder	15
45	adult	30
30	adult	30
20	adult	30
13	child	15
15	child	15
65	adult	30
70	elder	15
71	elder	15
68	elder	15
23	adult	30
36	adult	30
16	child	15
32	adult	30
28	adult	30
26	adult	30
76	elder	15

```
CREATE TABLE Questionnaire (
    QuestionnaireID INT PRIMARY KEY,
    VisitorID INT,
    GalleryID INT,
    RateForActivity INT,
    FavoriteArtist VARCHAR(50),
    FavoriteArtworkGenre VARCHAR(50),
    Comment TEXT,
    FOREIGN KEY (VisitorID) REFERENCES Visitor(VisitorID),
    FOREIGN KEY (GalleryID) REFERENCES Gallery(GalleryID)
);
```

Questionnaire 2023年12月2日 13:38:32

QuestionnaireID	VisitorID	GalleryID	RateForActivity	FavoriteArtist	FavoriteArtworkGenre	Comment
1	1	1	4	Aaron Kleeblatt	Painting	N/A
2	2	1	5	Aaron Kleeblatt	Painting	N/A
3	3	1	5	Omar Abulsheikh	Abstract	N/A
4	4	1	5	Omar Abulsheikh	Abstract	N/A
5	5	1	5	Omar Abulsheikh	Abstract	N/A
6	6	1	3	N/A	N/A	Most artworks doesn't make any sense to me.
7	8	1	5	Hubert Posey	Installation	N/A
8	9	1	5	Thomas Jackson	Modern	N/A
9	10	1	3	Pierre-Auguste Renoir	Impressionism	This artist's style is unique and stands out
10	11	1	4	Pierre-Auguste Renoir	Impressionism	The interactive exhibits are so engaging
11	12	1	5	Yayoi Kusama	Contemporary	N/A
12	13	1	4	Yayoi Kusama	Contemporary	The gallery space complements the artworks beautifully
13	14	1	5	Yayoi Kusama	Contemporary	I find her artwork very moving and powerful.
14	15	2	4	Olafur Eliasson	Contemporary	I love the use of color and light in his paintings.
15	16	2	4	Banksy	Contemporary	N/A
16	17	2	5	Olafur Eliasson	Contemporary	The atmosphere in this gallery is so serene
17	18	2	4	Frank Stella	Abstract	N/A
18	19	2	5	Édouard Manet	realism	The gallery and artwork are so prefect.
19	20	2	4	Thomas Eakins	realism	The artist is my favorite

Relationship view



5. Database Application

In this part, we will analyze the result from gallery 1 and 2, and we mainly focus on two parts. One is analysis for the sponsors, which includes the overview of people's preference on artworks. The other is for our gallery, which includes the analysis for how to make a better gallery next time.

Sponsor:

I. Century Period that Artist Represent

A. SQL Code

```
SELECT
   Century,
   SUM(IIF(JoinedData.GalleryID = 1, 1, 0)) AS Gallery1,
   SUM(IIF(JoinedData.GalleryID = 2, 1, 0)) AS Gallery2,
   COUNT(JoinedData.ArtworkID) AS TotalCount
FROM
(SELECT
      Artwork.ArtworkID, Sponsor.GalleryID,
      INT((Artwork.YearCreate - 1) / 100) + 1 AS Century
FROM (Artwork
   INNER JOIN
      Sponsor ON Artwork.SponsorID = Sponsor.SponsorID)) AS JoinedData
GROUP BY Century
ORDER BY Century;
```

B. Screenshot

Century	Gallery1	Gallery2	TotalCount
16	0	1	1
19	3	12	15
20	0	7	7
21	12	5	17

C. Explanation on Code

- The inner subquery (JoinedData) joins the Artwork table with the Sponsor table on the SponsorID.
- The century is defined based on the formula: Century=INT((YearCreate−1)/100)+; INT function is used to get integer result
- The IIF function is used to conditionally count artworks for each gallery. It adds 1 if the artwork belongs to a specific gallery and 0 otherwise.
- SUM(IIF(GalleryID = 1, 1, 0)) counts artworks in Gallery 1, and SUM(IIF(GalleryID = 2, 1, 0)) does the same for Gallery 2.
- COUNT(ArtworkID) provides the total count of artworks across both galleries for each century.

II. Number of artists and genres in each gallery

A. SQL Code

```
SELECT
   ArtistData.GalleryID,
```

```
    ArtistData.ArtistCount,
    GenreData.GenreCount
FROM
 (SELECT Sponsor.GalleryID,
            Count(Artwork.Artist) AS ArtistCount
 FROM
(SELECT DISTINCT Sponsor.GalleryID, Artwork.Artist
     FROM Artwork
     INNER JOIN Sponsor ON Artwork.SponsorID = Sponsor.SponsorID) AS UniqueArtists
     GROUP BY Sponsor.GalleryID) AS ArtistData
INNER JOIN
    (SELECT
       Sponsor.GalleryID,
       Count(Artwork.Genre) AS GenreCount
     FROM
       (SELECT DISTINCT Sponsor.GalleryID, Artwork.Genre
        FROM Artwork
        INNER JOIN Sponsor ON Artwork.SponsorID = Sponsor.SponsorID) AS
UniqueGenres
     GROUP BY Sponsor.GalleryID) AS GenreData
ON
    ArtistData.GalleryID = GenreData.GalleryID;
```

B. Screenshot

GalleryID	ArtistCount	GenreCount
1	6	6
2	21	6

C. Explanation on Code

- The subqueries UniqueArtists and UniqueGenres are used to count distinct artists and genres for each GalleryID.
- ArtistData and GenreData are the subqueries that are grouped by GalleryID and count distinct artists and genres respectively.
- These subqueries are then joined on GalleryID to provide a combined count of unique artists and genres for each gallery.

III. Most frequent Favorite genre/Artist of artwork

A. SQL Code

- Favorite Genres

```
SELECT * FROM (
    SELECT TOP 1 'Gallery 1' as Gallery, FavoriteArtworkGenre, COUNT(*) as GenreCount
    FROM Questionnaire
    WHERE GalleryID = 1 AND FavoriteArtworkGenre <> 'N/A'
    GROUP BY FavoriteArtworkGenre
    ORDER BY COUNT(*) DESC
) AS Gallery1TopGenre
```

```
UNION ALL

SELECT * FROM (
   SELECT TOP 1 'Gallery 2' as Gallery, FavoriteArtworkGenre, COUNT(*) as GenreCount
   FROM Questionnaire
   WHERE GalleryID = 2 AND FavoriteArtworkGenre <> 'N/A'
   GROUP BY FavoriteArtworkGenre
   ORDER BY COUNT(*) DESC
) AS Gallery2TopGenre

UNION ALL

SELECT * FROM (
   SELECT TOP 1 'All Galleries' as Gallery, FavoriteArtworkGenre, COUNT(*) as
GenreCount
   FROM Questionnaire
   WHERE FavoriteArtworkGenre <> 'N/A'
   GROUP BY FavoriteArtworkGenre
   ORDER BY COUNT(*) DESC
) AS OverallTopGenre;
```

IV. Favorite Artists:

```
SELECT * FROM (
   SELECT TOP 1 'Gallery 1' as Gallery, FavoriteArtist, COUNT(*) as ArtistCount
   FROM Questionnaire
   WHERE GalleryID = 1 AND FavoriteArtist <> 'N/A'
   GROUP BY FavoriteArtist
   ORDER BY COUNT(*) DESC
) AS Gallery1Artist

UNION ALL

SELECT * FROM (
   SELECT TOP 1 'Gallery 2' as Gallery, FavoriteArtist, COUNT(*) as ArtistCount
   FROM Questionnaire
   WHERE GalleryID = 2 AND FavoriteArtist <> 'N/A'
   GROUP BY FavoriteArtist
   ORDER BY COUNT(*) DESC
) AS Gallery2Artist

UNION ALL

SELECT * FROM (
   SELECT TOP 1 'All Galleries' as Gallery, FavoriteArtist, COUNT(*) as ArtistCount
   FROM Questionnaire
   WHERE FavoriteArtist <> 'N/A'
   GROUP BY FavoriteArtist
   ORDER BY COUNT(*) DESC
```

) AS GalleryArtist;

B. Screenshot

- **Genre:**

Gallery	FavoriteArtworkGenre	GenreCount
Gallery 1	Contemporary	3
Gallery 1	Abstract	3
Gallery 2	Historical	5
All Galleries	Contemporary	6
All Galleries	Abstract	6

- **Artists:**

Gallery	FavoriteArtist	ArtistCount
Gallery 1	Yayoi Kusama	3
Gallery 1	Omar Abulsheikh	3
Gallery 2	Olafur Eliasson	2
Gallery 2	Frank Stella	2
Gallery 2	Ferdinand Pettrich	2
Gallery 2	Daniel Chester French	2
All Galleries	Omar Abulsheikh	3
All Galleries	Yayoi Kusama	3

C. Code Explanation

- The code consists of three subqueries to find the top FavoriteArtworkGenre/ FavouriteArtist for each gallery and then for all galleries combined.
- Each subquery filters records by GalleryID and excludes genres marked as 'N/A', then groups the results by FavoriteArtworkGenre/FavouriteArtist.
- The SELECT TOP 1 statement in each subquery selects the genre with the highest occurrence in each group.
- The ORDER BY COUNT(*) DESC clause ensures the genres are sorted in descending order of their count, so the top genre is the one with the most occurrences.
- The UNION ALL operator combines the results of the three subqueries into a single result set.

V. Which visitor groups like our gallery most?

A. SQL Code

```
SELECT
   TicketType,
   SUM(IIF(GalleryID = 1, TicketTypeCount, 0)) AS Gallery1,
   SUM(IIF(GalleryID = 2, TicketTypeCount, 0)) AS Gallery2,
```

```
    SUM(TicketTypeCount) AS BothGalleries
FROM (
    SELECT
        TicketType,
        GalleryID,
        COUNT(*) AS TicketTypeCount
    FROM (
        SELECT DISTINCT
            Visitor.VisitorID,
            Ticket.TicketType,
            Questionnaire.GalleryID
        FROM
            (Visitor
            INNER JOIN Questionnaire ON Visitor.VisitorID = Questionnaire.VisitorID)
            INNER JOIN Ticket ON Visitor.Age = Ticket.Age
        WHERE
            Questionnaire.RateForActivity = 5
    ) AS Subquery
    GROUP BY TicketType, GalleryID
) AS CombinedSubquery
GROUP BY TicketType;
```

B. Screenshot

TicketType	Gallery1	Gallery2	BothGalleries
adult	4	3	7
child	3	1	4
elder	1	3	4

C. Code Explanation

- The SQL code creates a subquery that calculates the count of TicketType for each GalleryID separately and the overall count
- The conditional aggregation with IIF to calculate separate counts for Gallery 1 and Gallery 2 on GalleryID
- The subquery groups the results by TicketType and GalleryID.
- The whole query combines all subqueries and sums the counts based on GalleryID to get Gallery 1 and Gallery 2 counts and sums all counts to get the overall count.

VI. Which artist is the most popular one? Which artists have the most artworks in the galleries? How does their style or genre vary?

A. SQL Code

```
SELECT
    Artwork.Artist,
    Artwork.Genre,
    SUM(IIF(Sponsor.GalleryID = 1, 1, 0)) AS Gallery1,
    SUM(IIF(Sponsor.GalleryID = 2, 1, 0)) AS Gallery2,
    Count(Artwork.ArtworkID) AS BothGalleries
```

```
FROM
   Artwork
INNER JOIN
   Sponsor ON Artwork.SponsorID = Sponsor.SponsorID
GROUP BY
   Artwork.Artist,
   Artwork.Genre
ORDER BY
   Count(Artwork.ArtworkID) DESC,
   Artwork.Artist,
   Artwork.Genre;
```

B. Screenshot

Artist	Genre	Gallery1	Gallery2	BothGalleries
Omar Abulsheikh	Abstract	4	0	4
Aaron Kleeblatt	Painting	3	0	3
Olafur Eliasson	Contemporary	0	3	3
Pierre-Auguste Renoir	Impressionism	3	0	3
Banksy	Contemporary	0	2	2
Ferdinand Pettrich	Historical	0	2	2
Hubert Posey	Installation	2	0	2
Andrea di Pietro di Marco Ferrucci	Historical	0	1	1
Andrew Wyeth	Impressionism	0	1	1
Camille Pissarro	Impressionism	0	1	1
Daniel Chester French	Historical	0	1	1
Édouard Manet	realism	0	1	1
Ellsworth Kelly	Abstract	0	1	1
Frank Stella	Abstract	0	1	1
Gaetano Gandolfi	Painting	0	1	1
George Catlin	Painting	0	1	1
Gilbert Stuart	Painting	0	1	1
Heinrich Fuss	Historical	0	1	1
Joaquín Sorolla	Impressionism	0	1	1
Julian Schnabel	Abstract	0	1	1
Kazimir Malevich	Abstract	0	1	1
Louis Guglielmi	Painting	0	1	1
Ralph Eleaser Whiteside Earl	Painting	0	1	1
Thomas Eakins	realism	0	1	1
Thomas Jackson	Modern	1	0	1
Winslow Homer	realism	0	1	1
Yayoi Kusama	Contemporary	1	0	1
Yayoi Kusama	Installation	1	0	1

C. Code Explanation

- The query uses conditional aggregation (SUM(IIF(...))) to count artworks sponsored in Gallery 1 and Gallery 2 separately, and counts the total number of artworks sponsored in both galleries.
- The INNER JOIN clause joins the Artwork and Sponsor tables based on the SponsorID.
- The GROUP BY clause groups the results by Artist and Genre

- The ORDER BY clause orders the results first by the count of artworks in descending order, and then by artist and genre.

Summary/Analysis

In the area of exhibition trends: Artwork for the 21st century has been most exhibited in two galleries. Gallery 1 features 6 artists, and Gallery 2 features 21 artists. Both galleries showcase artworks from 6 different genres. In the area of favorite genres, In Gallery 1, the most frequent favorite genres are contemporary and abstract. In Gallery 2, the most frequent favorite genre is historical. In the area of visitor preferences: Adult visitor groups express a strong preference for both galleries. In the area of popular artists: Omar Abulsheikh emerges as the most popular artist in both galleries. He also has the most artworks on display in both galleries. Encourage a broader range of genres and styles to attract a more diverse audience. Consider rotating exhibitions to showcase different aspects of contemporary, abstract, historical, and other genres, especially in contemporary and abstract that visitors prefer. Consider providing guided tours, workshops, or lectures to enhance understanding and appreciation of the exhibited artworks. Plan special exhibitions or events based on the popularity of certain genres or artists. Keep an eye on emerging trends in the art world and incorporate them into the gallery's programming. In order to increase the society's interest in the exhibition, utilize digital platforms and social media to reach a wider audience. Collaborate with influencers or art critics to increase visibility and attract new visitors.

Gallery:

1. **Quantity of artworks and staff for gallery1 & 2:**

```
SELECT GalleryID, NumberOfArtwork, NumberOfStaff
FROM Gallery;
```

GalleryID	NumberOfArtwork	NumberOfStaff
1	24	6
2	16	6

Code Explanation: We select the existing result from the Gallery table.

2. **Number of Visitor:**

```
SELECT GalleryID, Count(VisitorID) as NumberOfVisitor
FROM Visitor
WHERE GalleryID is not NULL
GROUP BY GalleryID;
```

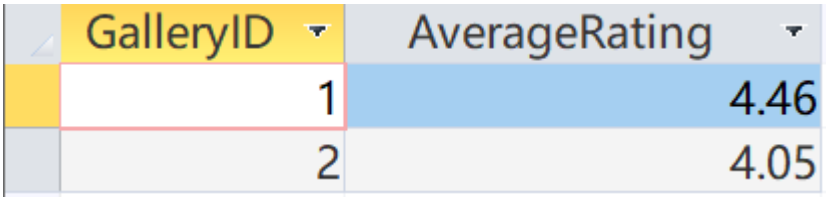
GalleryID	NumberOfVisitor
1	14
2	26

Code Explanation: We select the result from the Visitor table, group it by GalleryID and count the number of visitors.

3. **Average rate of visitor:**

```
SELECT GalleryID, ROUND(AVG(RateForActivity),2) as AverageRating
FROM Questionnaire
```

GROUP BY GalleryID;

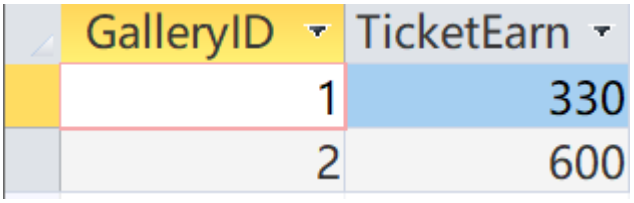


GalleryID	AverageRating
1	4.46
2	4.05

Code Explanation: We select the result from the Questionnaire table, group it by GalleryID and calculate average rate for each activity.

4. **Total ticket earning:**

```
SELECT v.GalleryID, SUM(t.TicketPrice) as TicketEarn
FROM Visitor v
LEFT JOIN Ticket t
ON v.Age = t.Age
WHERE GalleryID is not NULL
GROUP BY v.GalleryID;
```

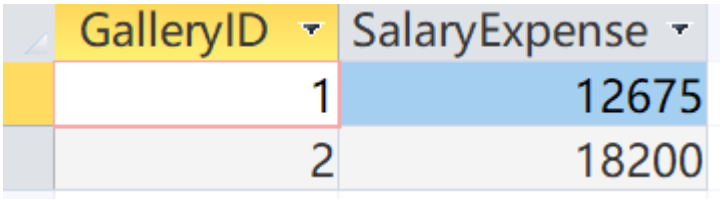


GalleryID	TicketEarn
1	330
2	600

Code Explanation: We select the result from the Visitor table and Ticket table, group it by GalleryID and calculate sum ticket price for each activity.

5. **Total worker expense:**

```
SELECT GalleryID, SUM(SalaryInHour*TotalWorkingHour) as SalaryExpense
FROM Staff
GROUP BY GalleryID;
```



GalleryID	SalaryExpense
1	12675
2	18200

Code Explanation: We select the result from the Staff table, group it by GalleryID and calculate sum SalaryInHour*TotalWorkingHour for each activity.

6. **Visitor response rate:**

```
SELECT v.GalleryID, ROUND(COUNT(q.VisitorID)/COUNT(v.VisitorID), 2) as ResponseRate
FROM Visitor v
LEFT JOIN Questionnaire q
ON v.VisitorID = q.VisitorID
WHERE v.GalleryID is not NULL
GROUP BY v.GalleryID;
```

GalleryID	ResponseRate
1	0.93
2	0.73

Code Explanation: We select the result from the Visitor table and Questionnaire table, group it by GalleryID and calculate the number of visitors who did the questionnaire/the number of visitors in the activity for each activity.

Summary/Analysis

The analysis of our art gallery activities in Midtown Manhattan reveals strengths and opportunities for improvement within Gallery 1 and Gallery 2. Gallery 1 stands out for its extensive and diverse collection of artworks by showcasing 24 artworks with 12 artworks from the 21st Century in a wider range of genres. In contrast, Gallery 2 implements a concentrated strategy that features a higher number of artworks within a specific genre like history. Based on the visitor statistics for each art gallery, Art Gallery 2 has a significantly higher number of visitors than Art Gallery 1. From the query of the number of visitors, we can draw conclusions that negotiating with our sponsors to provide more artworks related to history from the 21st century by a wider range of artists can increase the number of visitors. In terms of an average rating, Gallery 1 has a higher rating point than Gallery 2 although there are more visitors to Gallery 2. From that, we can see Gallery 1 has done a better job of meeting the audience's satisfaction. For example, we can improve our next exhibition by ensuring that each artwork's details are well highlighted and create a visually appealing environment. Incorporating interactive elements that encourage visitors to engage with artwork. This could include interactive installations that provide additional information or insights. From a financial perspective, Gallery 2 incurs higher salary expenses, reflecting inefficiencies in operations. Despite earning more, Gallery 2's less efficient use of working hours results in a smaller number of artworks displayed compared to Gallery 1. A thorough evaluation of staff contributions and working hours is imperative to optimize efficiency and maximize profits. For example, clearly define and communicate the roles and responsibilities of each staff member. This ensures that everyone performs their specific duty to the gallery's goals as well as conducting regular performance reviews to assess each staff performance.. In summary, this comprehensive analysis serves as a valuable guidance for continuous improvement and creates a more satisfying experience for visitors in future our art gallery activities.

6. Conclusion

In conclusion, we have presented in this report a comprehensive view of our galleries in midtown Manhattan. The transition from paper-based data management to the sophisticated database system was crucial, as it allowed us for a detailed examination of various operational and strategic aspects of these galleries.

We have explored entity-relationship modeling and normalization, ensuring an optimal database structure for efficiently managing extensive gallery data. This process laid the groundwork for in-depth SQL-based analysis, providing valuable insights into exhibition trends, visitor preferences, and financial performance.

Examination of exhibition trends revealed the prominence of 21st-century artwork in gallery 1 and 2, with varying approaches to genre representation. Visitor preferences, notably adult groups, were highlighted, influencing strategic decisions for future exhibitions. Additionally, famous artists and their artwork counts shed light on the galleries' strengths.

Recommendations stemming from the analysis are centered around enhancing the gallery experience and sustaining success. Suggestions include diversifying artwork genres, implementing engaging factors, optimizing staff efficiency, and targeting promotions to specific visitor groups.

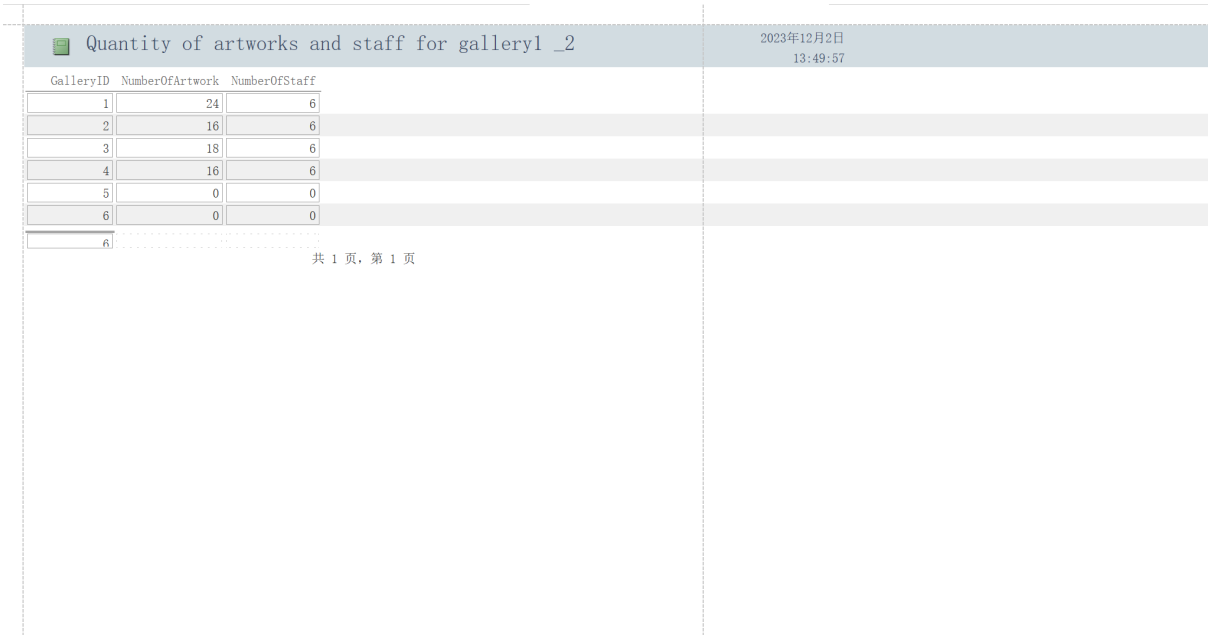
The detailed financial analysis emphasized the importance of optimizing staff contributions, reducing inefficiencies, and exploring avenues to boost revenue, such as targeted promotions and membership programs.

In general, this analysis serves as a roadmap for our continuous improvement, ensuring a more engaging and satisfying experience for visitors in future art gallery 5 and 6 while maximizing operational efficiency and financial success.

Appendix

These are the results from the database after adding more data.

Quantity of artworks and staff for 6 galleries



Quantity of artworks and staff for gallery1 _2

2023年12月2日 13:49:57

GalleryID	NumberOfArtwork	NumberOfStaff
1	24	6
2	16	6
3	18	6
4	16	6
5	0	0
6	0	0

6

共 1 页，第 1 页

Report of Number of Visitor (This is the database after adding more data)

Number of Visitor

2023年12月2日
13:45:24

GalleryID	NumberOfVisitor
1	14
2	26
3	16
4	24

4