

Webbene

1. Team and topic

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Github link: <https://github.com/180107106/webbene>

About project: The project "Korme" is an online exhibition site where the user can upload their works, sell and buy them. The task of the site is to raise the level of art in our country, since it is not sufficiently developed here. This site will provide all artists, photographers and general art lovers with the opportunity to share their work and grants copyright.

2. Project description and data preparation

Link: <https://www.kaggle.com/ikarus777/best-artworks-of-all-time>

Before starting our project, we looked for a suitable database. From this site we got a csv file. We edited this file and compiled several tables, such as users, art, types of art and sold.

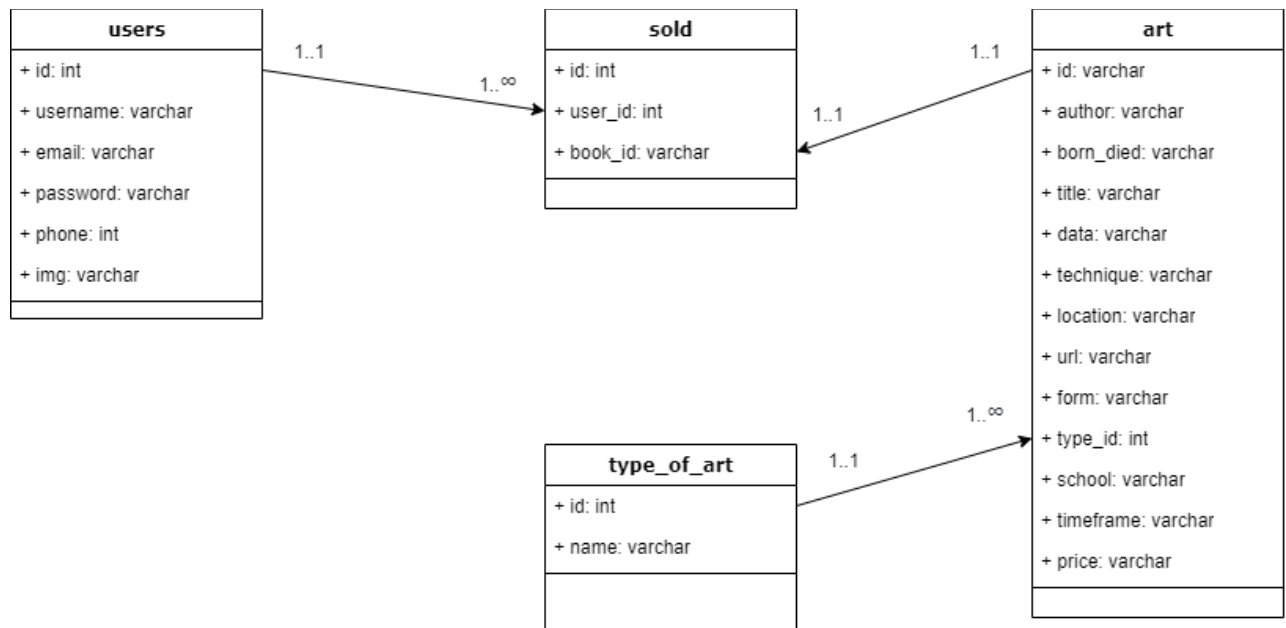
3. Project Use-Case diagram and questions over the date

Based on our project, we have compiled 15 questions. There are:

1. Can I see artists by genre?
2. Is it possible to see paintings created only in the 19th century?
3. How to see paintings created only by the French?
4. Find out the number of works by French artists from the 19th century?
5. See the expressionist artists who are only Italians?
6. Get the most expensive art
7. See the Renaissance paintings by ADRIANO FIORENTINO?
8. Pictures of French and German artists created in 1920-1950?
9. How can I view all the works of one artist?
10. How many works in total are architecture and sculpture?
11. In what style are more works in 1884?
12. How to view bought mythological arts of specific user?
13. What count of sold portrait art?
14. What count of sold religious art?
15. Which sold art is the most expensive?

4 Data modeling and database design

E/R diagram:



DDL queries: Webbene-DDL-queries.sql

```
CREATE TABLE users (  
  id int NOT NULL PRIMARY KEY AUTO_INCREMENT,  
  username varchar(100) NOT NULL,  
  email varchar(100) NOT NULL,  
  password varchar(100) NOT NULL,  
  phone int NOT NULL,  
  img varchar(255) DEFAULT NULL  
);
```

```
CREATE TABLE art (  
  id varchar(255) PRIMARY KEY,  
  author varchar(255),  
  born_died varchar(255),  
  title varchar(255),  
  data varchar(255),  
  technique varchar(255),  
  location varchar(255),  
  url varchar(255),  
  form varchar(255),  
  type_id int,  
  school varchar(255),  
  timeframe varchar(255),  
  price varchar(255),  
  FOREIGN KEY (type_id) REFERENCES type_of_art(id)  
);
```

```
CREATE TABLE sold(  
  id int PRIMARY KEY AUTO_INCREMENT,  
  user_id int,  
  book_id varchar(255),  
  FOREIGN KEY (user_id) REFERENCES users(id),  
  FOREIGN KEY (book_id) REFERENCES art(id)
```

```
);
```

```
CREATE TABLE type_of_art (  
    id int PRIMARY KEY,  
    name varchar(255)  
);
```

DML data load: Webbene-DML-data-load.sql

5 SQL queries

-- 1. Can I see artists by genre?

```
select distinct(author) from art inner join type_of_art on art.type_id = type_of_art.id where  
type_of_art.name = "mythological";
```

-- 2. Is it possible to see paintings created only in the 19th century?

```
select * from art where form = "painting" and data > 1800 and data < 1900;
```

-- 3. How to see paintings created only by the French?

```
select * from art where form = "painting" and school = "French";
```

-- 4. Find out the number of works by French artists from the 19th century?

```
select count(*) from art where data > 1800 and school = "French";
```

-- 5. See the expressionist artists who are only Italians?

```
select author from art where school = "Italian";
```

-- 6. Get the most expensive art

```
select * from art where price in (select max(price) from art);
```

-- 7. See the Renaissance paintings by ADRIANO FIORENTINO?

```
select * from art where author = "ADRIANO FIORENTINO";
```

-- 8. Pictures of French and German artists created in 1920-1950?

```
select * from art where school in ("French", "German") and data between "1900" and "1950";
```

-- 9. How can I view all the works of one artist?

```
select * from art where author = "?";
```

-- 10. How many works in total are architecture and sculpture?

```
select count(*) from art where form in ("architecture", "sculpture");
```

-- 11. In what style are more works in 1884?

```
select count(distinct(school)) from art where data = "1884";
```

-- 12. How to view bought mythological arts of specific user?

```
select * from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id where sold.user_id = 1 and type_of_art.name = "mythological";
```

-- 13. What count of sold portrait art?

```
select count(*) from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id where type_of_art.name = "portrait";
```

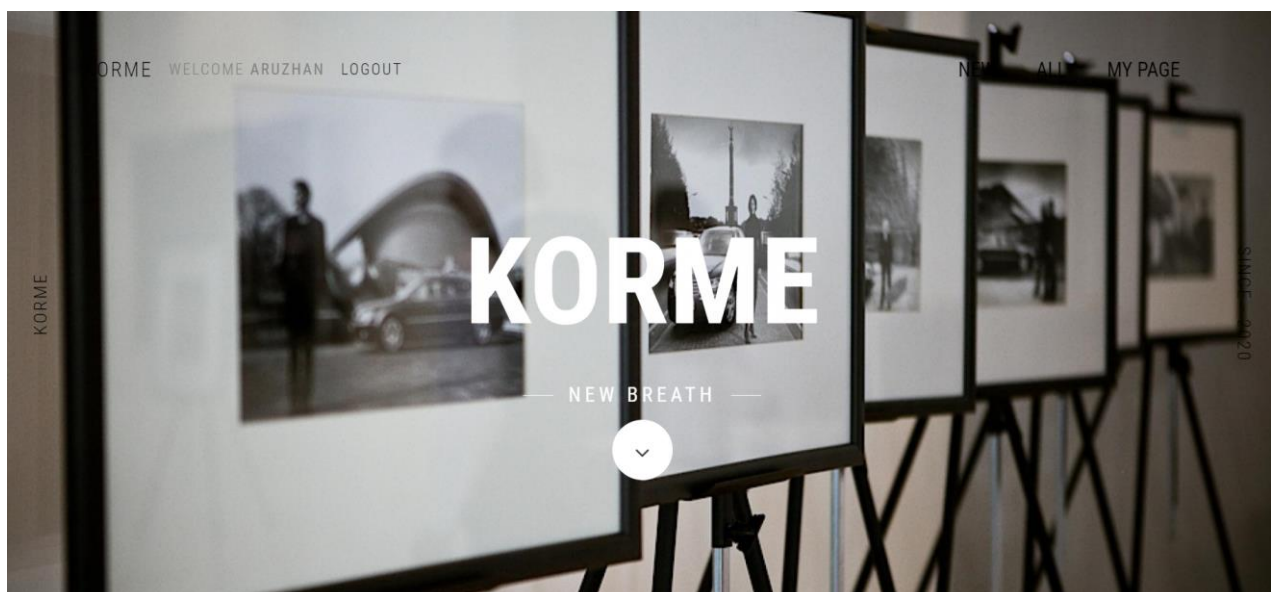
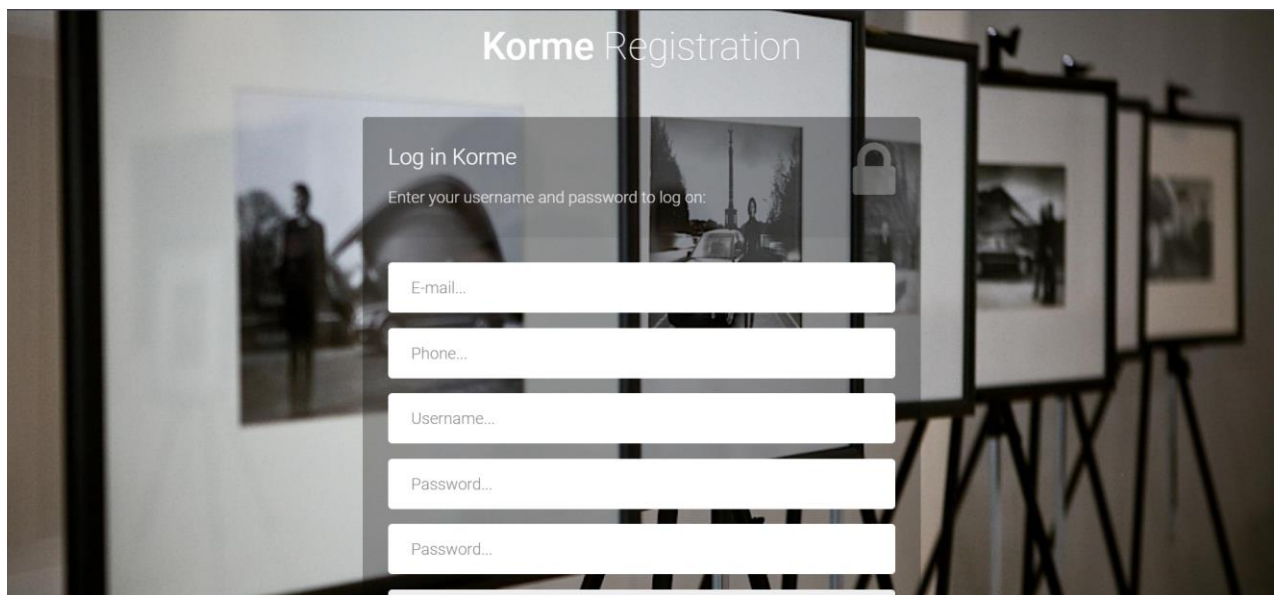
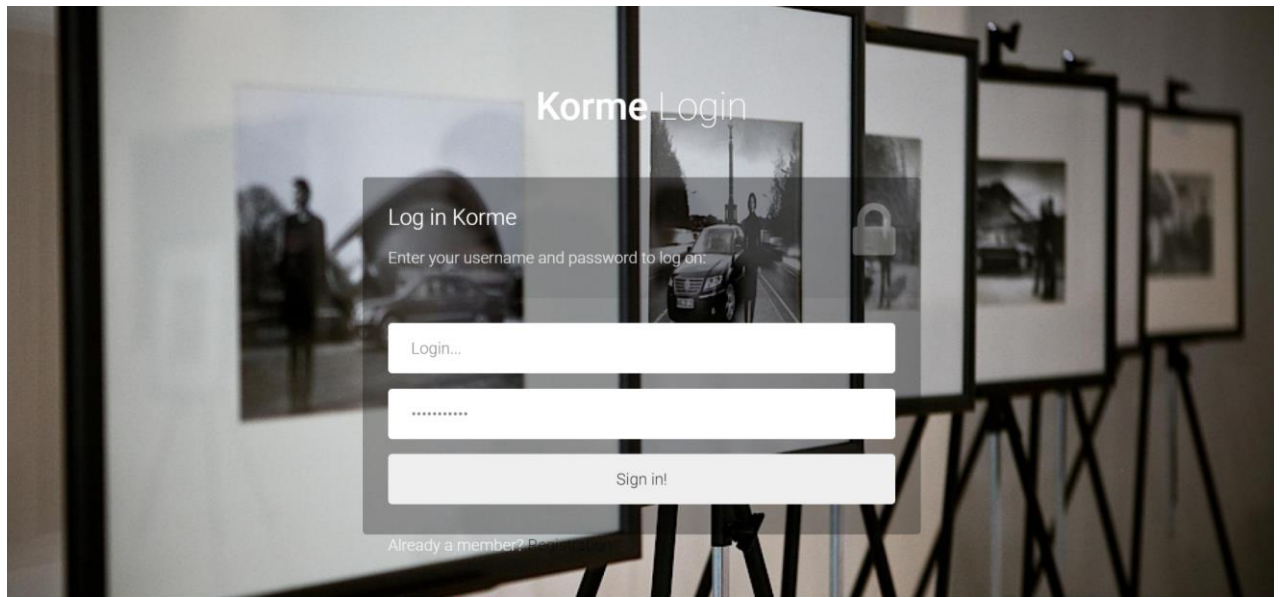
-- 14. What count of sold religious art?

```
select count(*) from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id where type_of_art.name = "religious";
```

-- 15. Which sold art is the most expensive?

```
select * from sold inner join art on sold.book_id = art.id order by price limit 1;
```

6 User-interface implementation and connection



ALL

KORME



ABBATE, Niccolo dell' Decoration



ABBATE, Niccolo dell' Decoration
(detail)



ABBATE, Niccolo dell' Meeting of
Charles V and the Bey of Tunis



ABBATE, Niccolo dell' Moses
Rescued from the Nile

SINCE - 2020

MY ACCOUNT

HI. I'M ARUZHAN

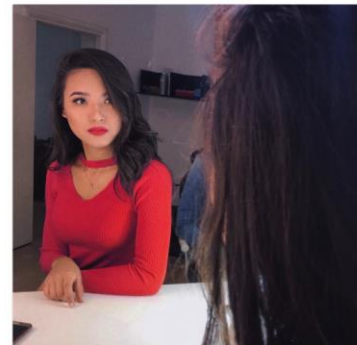
ABOUT ME:

My phone number is 8777777777

My email is Aruzhan

DELETE ACCOUNT

Update Account

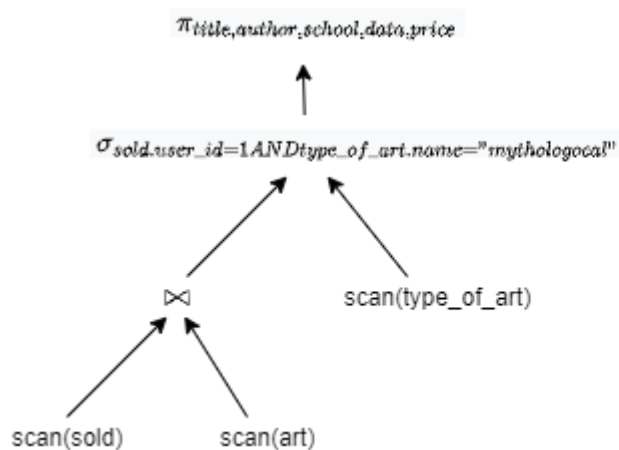


7 SQL to Relational Algebra operators

1)

select title, author, school, data, price from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id where sold.user_id = 1 and type_of_art.name = "mythological";

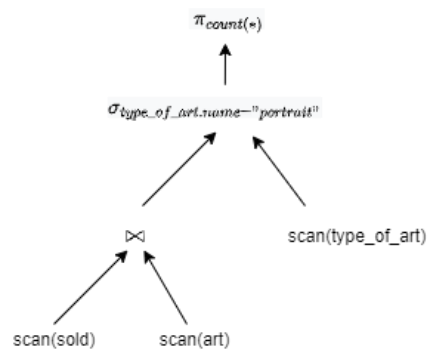
$$T' = \pi_{title, author, school, data, price} (\sigma_{sold.user_id=1 \wedge type_of_art.name="mythological"} (sold \bowtie_{sold.book_id=art.id} art \bowtie_{art.type_id=type_of_art.id} type_of_art))$$



2)

select count(*) from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id where type_of_art.name = "portrait";

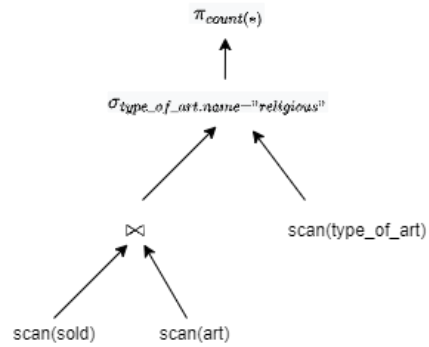
$$T' = \pi_{count(*)} (\sigma_{type_of_art.name="portrait"} (sold \bowtie_{sold.book_id=art.id} art \bowtie_{art.type_id=type_of_art.id} type_of_art))$$



3)

select count(*) from sold inner join art on sold.book_id = art.id inner join type_of_art on art.type_id = type_of_art.id
where type_of_art.name = "religious";

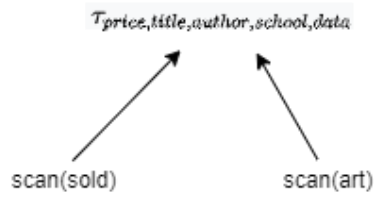
$T = \pi_{count(*)} (\sigma_{type_of_art.name="religious"} (sold \bowtie_{sold.book_id=art.id} art \bowtie_{art.type_id=type_of_art.id} type_of_art))$



4)

select title, author, school, data, price from sold inner join art on sold.book_id = art.id order by price limit 1;

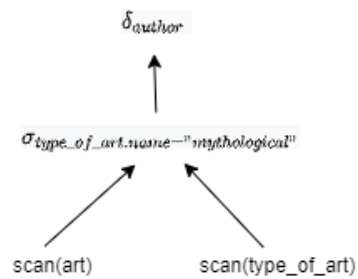
$T = \tau_{price,title,author,school,data} (sold \bowtie_{sold.book_id=art.id} art)$



5)

select distinct(author) from art inner join type_of_art on art.type_id = type_of_art.id where type_of_art.name = "mythological";

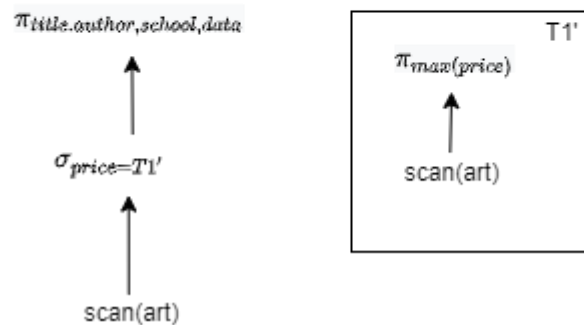
$T = \delta_{author} (\sigma_{type_of_art.name="mythological"} (art \bowtie_{art.type_id=type_of_art.id} type_of_art))$



6)

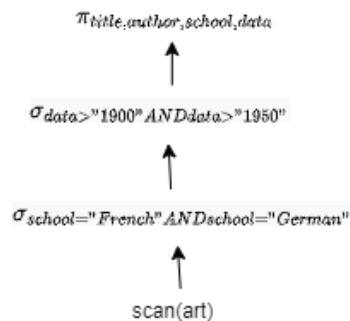
```
select title, author, school, data from art where price = (select max(price) from art);
```

$$T' = \pi_{title, author, school, data} (\sigma_{price=T1'} (art))$$

$$T1' = \pi_{max(price)} (art)$$


7)

```
select title, author, school, data from art where school in ("French", "German") and data between "1900" and "1950";
```

$$T' = \pi_{title, author, school, data} (\sigma_{school="French" \text{ AND } school="German" \text{ AND } data > "1900" \text{ AND } data < "1950"} (art))$$


8 Calculating true cardinalities and plan evaluation

1-cardinality

```
select title, author, school, data, price from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
where sold.user_id = 1 and type_of_art.name = "mythological";
```

```
-- First join selection
-- (sold join art) join type_of_art
-- Join cardinalities: 499 + 499 + 1 + 1 = 1000
-- Join estimation: |T| = 18 * 499 * 10 / 18 / 10 / 18 / 10 ~ 2.77 = 3
-- Time: 190ms
```

```
select title, author, school, data, price from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
```

```
where sold.user_id = 1 and type_of_art.name = "mythological";
```

```
-- Second join selection
-- (art join sold) join type_of_art
-- Join cardinalities: 499 + 499 + 1 + 1 = 1000
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 18 / 10 \sim 2.77 = 3$ 
-- Time: 184ms
```

```
select title, author, school, data, price from art
  inner join sold on art.id = sold.book_id
  inner join type_of_art on art.type_id = type_of_art.id
where sold.user_id = 1 and type_of_art.name = "mythological";
```

```
-- Third join selection
-- (type_of_art join art) join sold
-- Join cardinalities: 499 + 499 + 1 + 1 = 1000
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 18 / 10 \sim 2.77 = 3$ 
-- Time: 309ms
```

```
select title, author, school, data, price from type_of_art
  inner join art on type_of_art.id = art.type_id
  inner join sold on sold.book_id = art.id
where sold.user_id = 1 and type_of_art.name = "mythological";
```

2-cardinality

```
select count(*) from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
where type_of_art.name = "portrait";
```

```
-- First join selection
-- (sold join art) join type_of_art
-- Join cardinalities: 499 + 499 + 1 = 999
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 360ms
```

```
select count(*) from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
where type_of_art.name = "portrait";
```

```
-- Second join selection
-- (art join sold) join type_of_art
-- Join cardinalities: 499 + 499 + 1 = 999
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 250ms
```

```
select count(*) from art
  inner join sold on art.id = sold.book_id
  inner join type_of_art on art.type_id = type_of_art.id
where type_of_art.name = "portrait";
```

```
-- Third join selection
-- (type_of_art join art) join sold
-- Join cardinalities: 499 + 499 + 1 = 999
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 273ms
```

```
select count(*) from type_of_art
  inner join art on art.type_id = type_of_art.id
  inner join sold on sold.book_id = art.id
where type_of_art.name = "portrait";
```

3-cardinality

```
select count(*) from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
  where type_of_art.name = "religious";

-- First join selection
-- (sold join art) join type_of_art
-- Join cardinalities:  $499 + 499 + 1 = 999$ 
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 633ms
```

```
select count(*) from sold
  inner join art on sold.book_id = art.id
  inner join type_of_art on art.type_id = type_of_art.id
  where type_of_art.name = "religious";

-- Second join selection
-- (art join sold) join type_of_art
-- Join cardinalities:  $499 + 499 + 1 = 999$ 
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 421ms
```

```
select count(*) from art
  inner join sold on art.id = sold.book_id
  inner join type_of_art on art.type_id = type_of_art.id
  where type_of_art.name = "religious";

-- Third join selection
-- (type_of_art join art) join sold
-- Join cardinalities:  $499 + 499 + 1 = 999$ 
-- Join estimation:  $|T| = 18 * 499 * 10 / 18 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 469ms
```

```
select count(*) from type_of_art
  inner join art on art.type_id = type_of_art.id
  inner join sold on sold.book_id = art.id
  where type_of_art.name = "religious";
```

4-cardinality

```
select title, author, school, data, price from sold
  inner join art on sold.book_id = art.id
  order by price limit 1;
```

```
-- First join selection
-- sold join art
-- Join cardinalities: 499
-- Join estimation:  $|T| = 18 * 499 / 18 = 499$ 
-- Time: 296ms
```

```
select title, author, school, data, price from sold
  inner join art on sold.book_id = art.id
  order by price limit 1;
```

```
-- Second join selection
-- art join sold
-- Join cardinalities: 499
-- Join estimation:  $|T| = 18 * 499 / 18 = 499$ 
-- Time: 350ms
```

```
select title, author, school, data, price from art
  inner join sold on art.id = sold.book_id
 order by price limit 1;
```

5-cardinality

```
select distinct(author) from art
  inner join type_of_art on art.type_id = type_of_art.id
 where type_of_art.name = "mythological";
```

```
-- First join selection
-- art join type_of_art
-- Join cardinalities:  $499 + 1 = 500$ 
-- Join estimation:  $|T| = 10 * 499 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 748ms
```

```
select distinct(author) from art
  inner join type_of_art on art.type_id = type_of_art.id
 where type_of_art.name = "mythological";
```

```
-- Second join selection
-- type_of_art join art
-- Join cardinalities:  $499 + 1 = 500$ 
-- Join estimation:  $|T| = 10 * 499 / 10 / 10 \sim 49.9 = 50$ 
-- Time: 364ms
```

```
select distinct(author) from type_of_art
  inner join art on type_of_art.id = art.type_id
 where type_of_art.name = "mythological";
```

6-cardinality

```
select title, author, school, data from art where price = (select max(price) from art);
```

```
-- Cardinalities:  $499 + 1 + 499 = 999$ 
-- Join estimation:  $|T| = 499 / 499 = 1$ 
```

7-cardinality

```
select title, author, school, data from art where school in ("French", "German") and data between "1900" and "1950";
```

```
-- Cardinalities:  $499 + 53 + 1 = 553$ 
-- Join estimation:  $|T| = 499 * 2 / 3 / 499 \sim 0.66 = 1$ 
```

9 Speed performance evaluation

1-cardinality

Experiment 1:
Time: 0.55390 ms

Experiment 2:
Time: 0.55760 ms

Experiment 3:
Time: 0.66920 ms

Experiment 4:

Time: 0.47120 ms

Experiment 5:
Time: 0.54940 ms

$2.80130 / 5 = 0.56026$

Average runtime: 0.56026 ms

2-cardinality

Experiment 1:
Time: 0.81620 ms

Experiment 2:
Time: 0.52630 ms

Experiment 3:
Time: 0.64910 ms

Experiment 4:
Time: 0.92710 ms

Experiment 5:
Time: 0.63640 ms

$3.55510 / 5 = 0.71102$

Average runtime: 0.71102 ms

3-cardinality

Experiment 1:
Time: 0.49000 ms

Experiment 2:
Time: 0.75530 ms

Experiment 3:
Time: 0.70100 ms

Experiment 4:
Time: 0.55700 ms

Experiment 5:
Time: 0.71160 ms

$3.21490 / 5 = 0.64298$

Average runtime: 0.64298 ms

4-cardinality

Experiment 1:
Time: 0.68000 ms

Experiment 2:
Time: 0.41580 ms

Experiment 3:
Time: 0.41420 ms

Experiment 4:
Time: 0.43570 ms

Experiment 5:
Time: 0.49860 ms

$2.44430 / 5 = 0.48886$

Average runtime: 0.48886 ms

5-cardinality

Experiment 1:
Time: 0.59530 ms

Experiment 2:
Time: 0.66890 ms

Experiment 3:
Time: 0.99460 ms

Experiment 4:
Time: 0.58940 ms

Experiment 5:
Time: 0.73700 ms

$3.58070 / 5 = 0.71614$

Average runtime: 0.71614 ms

6-cardinality

Experiment 1:
Time: 1.68950 ms

Experiment 2:
Time: 1.25070 ms

Experiment 3:
Time: 1.30120 ms

Experiment 4:
Time: 1.65170 ms

Experiment 5:
Time: 0.99960 ms

$6.89270 / 5 = 1.37854$

Average runtime: 1.37854 ms

7-cardinality

Experiment 1:
Time: 1.11970 ms

Experiment 2:
Time: 0.58300 ms

Experiment 3:
Time: 0.61670 ms

Experiment 4:
Time: 0.60220 ms

Experiment 5:
Time: 0.79250 ms

$3.71410 / 5 = 0.74282$

Average runtime: 0.74282 ms

10 Presentation and Demo