Database Systems
Take-home test 2, spring, 2019
Due by May 7, 2019 *(submit answers as hard copy)*
Department of Mathematics and Computer Science

- Answer to the questions that you omitted in the midterm examination
- Correct your answers to the questions that you could not complete in the midterm examination

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Database Systems
Midterm Examination, spring, 2019
[Q.1] Answer the following questions

You are invited as a database architect to develop database schema for maintaining Lehman Bistro menu. We assume we completed conceptual schema of Lehman Bistro menu, and mapped to the logical schema drew in MySQL EER as shown below.
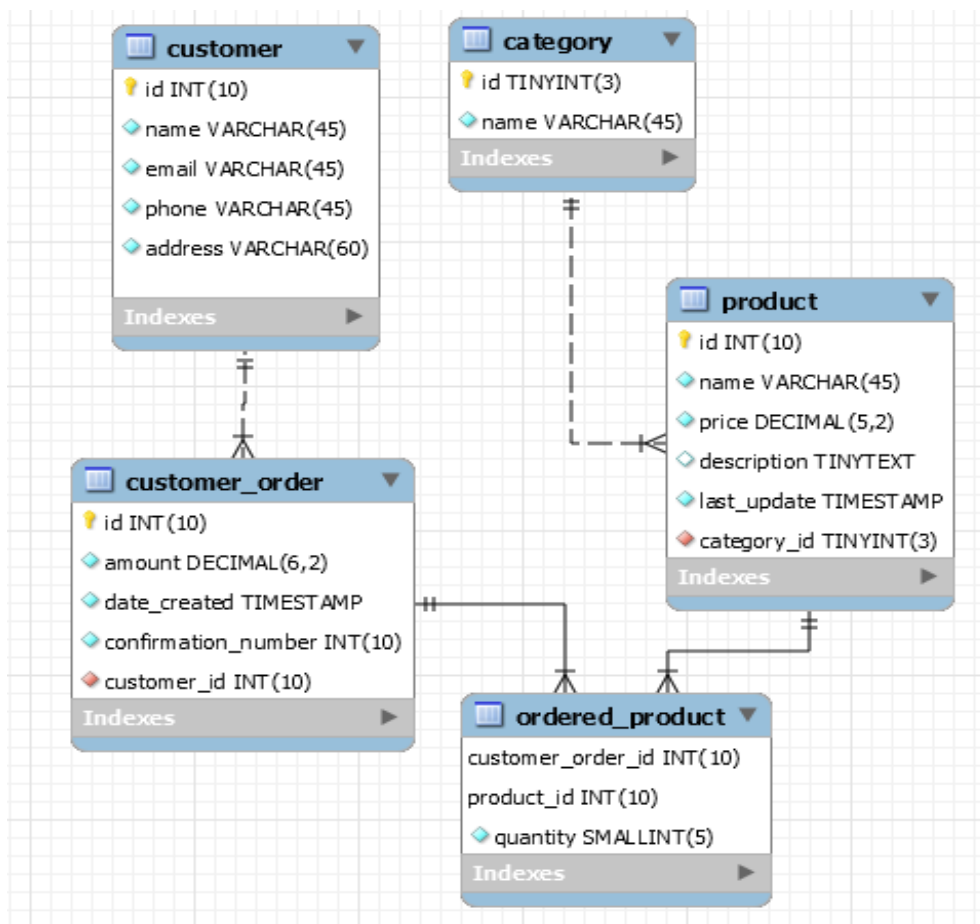
You do not need to worry about indexes data objects. **Note** customer_order_id, and product_id together is the primary key of the ordered_product table schema (table relation).

The following tables show the current state of each table (relation)

category table

id	name
▶ 1	american
2	chinese
3	italian
4	mexican

customer table

id	name	email	phone	address
▶ 1	Bob Schneider	bs@lehman.edu	718-960-1112	123 Bedford Blvd, NY, NY
2	Tiger Forest	tf@lehman.edu	718-960-1234	125 Bedford Blvd, NY, NY
3	Mark Jordan	mj@lehman.edu	718-960-4426	225 Bedford Blvd, NY, NY

Product table

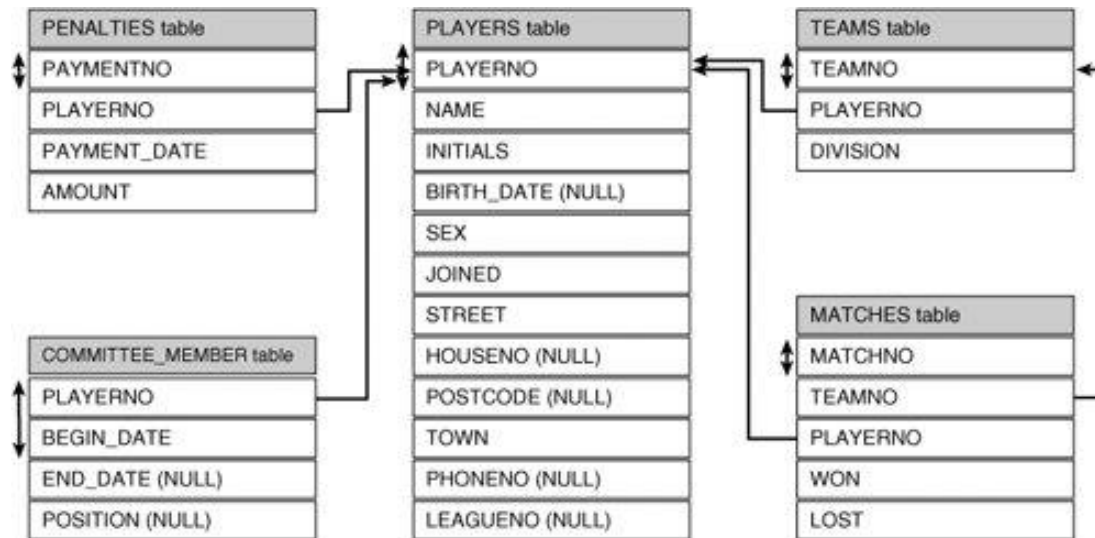| id	name	price	description	last_update	category_id
▶ 1	burger	5.70	hamburger sandwich consisting of one cooked p...	2019-03-20 14:47:50	1
2	chickensandwich	6.39	grilled chicken sandwich	2019-03-20 14:47:50	1
3	friedchicken	7.99	5 piece fried chicken meal	2019-03-20 14:47:50	1
4	salad	6.76	caesar chicken salad	2019-03-20 14:47:50	1
5	forkstirfry	6.29	prime fork stir fry	2019-03-20 14:47:50	2
6	kung-pao-chicken	6.49	simmering chicken in a flavorful sauce made wit...	2019-03-20 14:47:51	2
7	mugugaipan	6.59	stir-fried dish consisting of sliced or cubed chick...	2019-03-20 14:47:51	2
8	szechuanchicken	6.55	spicy Szechuan chicken	2019-03-20 14:47:51	2
9	italianpizza	4.89	two piece italian pizza with three toppings	2019-03-20 14:47:51	3
10	italiansausagesandwich	6.19	roasted italian sausage peppers mushroom san...	2019-03-20 14:47:51	3
11	seafoodpasta	8.15	Italian Seafood Pasta	2019-03-20 14:47:51	3
12	spaghetti	6.39	slow-cooked meatballs spaghetti	2019-03-20 14:47:51	3
13	beeftacos	6.59	beef tacos served with salad and fresh tomatoe...	2019-03-20 14:47:51	4
14	fajitas	7.49	beef fajitas	2019-03-20 14:47:51	4
15	quesadilla	6.29	A flour tortilla is heated on a griddle, then flippe...	2019-03-20 14:47:51	4
16	Burrito	6.49	a warm, soft flour tortilla wrapped around seas...	2019-03-20 14:47:52	4

customer_order table

id	amount	date_created	confirmation_number	customer_id
1	68.64	2019-03-21 07:01:44	1	1
2	58.71	2019-03-21 07:01:44	2	2
3	12.78	2019-03-21 07:01:44	3	3

ordered_product table

customer_order_id	product_id	quantity
1	1	5
1	3	5
2	5	2
2	7	3
3	2	2

a) Explain entity integrity constraint, and show an example
b) Explain referential integrity constraint and show two examples
c) Explain the difference between solid line connecting two entity types and dotted line connecting two entity types
d) Show how to insert a new tuple into the customer table, please note that the customer id is auto generated.
e) Write a SQL statement to retrieve customer name, email, and maximum order amount
f) Write a SQL statement to list products grouped by each category name
g) Write a SQL statement to retrieve at least 3 products in each category from the product table

[Q.2] Answer the following questions based on the tennis database schema

PENALTIES table
PAYMENTNO
PLAYERNO
PAYMENT_DATE
AMOUNT

PLAYERS table
PLAYERNO
NAME
INITIALS
BIRTH_DATE (NULL)
SEX
JOINED
STREET
HOUSENO (NULL)
POSTCODE (NULL)
TOWN
PHONENO (NULL)
LEAGUENO (NULL)

TEAMS table
TEAMNO
PLAYERNO
DIVISION

COMMITTEE_MEMBER table
PLAYERNO
BEGIN_DATE
END_DATE (NULL)
POSITION (NULL)

MATCHES table
MATCHNO
TEAMNO
PLAYERNO
WON
LOST

(a) Write a SQL to create a view that stores all town names from the players table. And write a SQL to retrieve the date from the view

(b) Write a SQL statement to retrieve the number of top 3 best players. The best player is defined as the person with highest matches won

(c) Write a SQL statement to retrieve 3 lowest penalty amounts from the penalties table

(d) MySQL supports UNION operator, so the following SQL works

Select playerno
   From players
Union
Select playersno
From matches

MySQL however does not provide intersection operator. Write a SQL statement using temptable (and populate tuple by select statements) to get the intersection of two sets of players.

[Q.3] Answer the following questions for a simple library application.

The data requirements of the library application are summarized as follows: Design an ER schema for this application, and draw an ER diagram for that schema. Specify key attributes of each entity type and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete.

- BOOK entity is identified by BookId, it has title and multiple author names.
- PUBLISHER entity consists of Name, Address, and Phone attributes. Name is the key for the PUBLISHER.
- LIBRARY_BRANCH entity has BranchId as a key and BranchName attribute additionally.
- Each LIBRARY_BRANCH has one or more copies of the same book. In such a case, noOfCopies attribute needs to be maintained by the relationship type.
- BORROWER entity has BrowerId as key and additionally has name, address, phone attributes.

- A book is published by only one publisher. A book can be loaned to a borrower at a specific library branch.

a) Draw ER diagram for the conceptual schema of the library database application. Note: you may need to have appropriate assumptions in requirements gathering process in order to make the specification complete.
b) Map the conceptual schema to logical database schema.
c) Write SQL queries for the following queries on the library database:
   a. How many copies of the book titled "Database Systems" are owned by the library branch "Lehman"?
   b. Write a SQL to retrieve the names of all borrowers who checked out any book
   c. Write a SQL, for each library branch, retrieve the name and the total number of books loaned out from the library branch.

[Q.4] Answer the questions based on the following three tables populated in the company database as shown below

Employee		
SSN	Fname	Lname
222443333	Jim	Brown
333556666	John	Aikman
456789999	Adam	Smith
555225555	Rob	Scneider

Works_On		
Essn	Pno	Hours
222443333	1	20
222443333	2	22
222443333	3	10
333556666	1	15
456789999	6	12
555225555	2	20
555225555	3	10

Project			
Pname	Pnumber	Plocation	Dnum
ProjA	1	Boston	3
ProjB	2	NYC	3
ProjC	3	Chicago	3
ProjD	6	Atlanta	2

a) **Show data retrieved by the following query**

```
SELECT Fname, Lname
    FROM EMPLOYEE
    WHERE EXISTS ( SELECT *
                        FROM WORKS_ON WO1
                        WHERE ( WO1.PNO IN (SELECT PNUMBER
                                                FROM PROJECT
                                                    WHERE DNUM = 3)
                            AND
                            EXISTS (SELECT *
                                    FROM WORKS_ON WO2
                                        WHERE WO2.ESSN = SSN AND WO2.PNO =
WO1.PNO) ) );
```

b) **Show data retrieved by the following query**

```
SELECT Fname, Lname
    FROM EMPLOYEE
    WHERE NOT EXISTS ( SELECT *
```

```
                    FROM WORKS_ON WO1
                    WHERE ( WO1.PNO IN (SELECT PNUMBER
                                        FROM PROJECT
                                        WHERE DNUM = 3)
                    AND
                    EXISTS (SELECT *
                            FROM WORKS_ON WO2
                            WHERE WO2.ESSN = SSN AND WO2.PNO =
WO1.PNO) )  );
```

c) Show data retrieved by the following query

```
SELECT Fname, Lname
    FROM EMPLOYEE
    WHERE EXISTS ( SELECT *
                    FROM WORKS_ON WO1
                    WHERE ( WO1.PNO IN (SELECT PNUMBER
                                        FROM PROJECT
                                        WHERE DNUM = 3)
                    AND
                    NOT EXISTS (SELECT *
                            FROM WORKS_ON WO2
                            WHERE WO2.ESSN = SSN AND WO2.PNO =
WO1.PNO) )  );
```

d) Show data retrieved by the following query

```
SELECT Fname, Lname
    FROM EMPLOYEE
    WHERE NOT EXISTS ( SELECT *
                    FROM WORKS_ON WO1
                    WHERE ( WO1.PNO IN (SELECT PNUMBER
                                        FROM PROJECT
                                        WHERE DNUM = 3)
                    AND
                    NOT EXISTS (SELECT *
                            FROM WORKS_ON WO2
                            WHERE WO2.ESSN = SSN AND WO2.PNO =
WO1.PNO) )  );
```

e) Explain difference between left outer join and inner join, write a SQL query to retrieve data by
    left outer join of Employee and Works_On table

f) Write a SQL query to retrieve Dnum to control at least 3 projects