CS 327E Lecture 5

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Agenda

- Readings for today
- Reading Quiz
- Concept Questions
- Homework for next time

Homework for Today

- Chapter 10 from the Learning SQL book
- Exercises at the end of Chapter 10

Quiz Question 1

```
mysql> select * from customer;
+---------+-------------+
| cust_id | fed_id      |
+---------+-------------+
|       1 | 111-11-1111 |
|       2 | 222-22-2222 |
|       3 | 333-33-3333 |
|       4 | 444-44-4444 |
|       5 | 555-55-5555 |
+---------+-------------+
```

```
mysql> select * from account;
+---------+------------+------------+
| cust_id | account_id | product_cd |
+---------+------------+------------+
|       1 |          1 | CHK        |
|       1 |          2 | SAV        |
|       2 |          3 | CD         |
|       3 |          7 | CHK        |
+---------+------------+------------+
```

How many **rows** does the following query return?

```
SELECT *
FROM customer c LEFT OUTER JOIN account a
ON c.cust_id = a.cust_id;
```

A. 3 B. 4 C. 5 D. 6

Quiz Question 2

```
mysql> select * from employee;
+---------+-----------+---------+
| fname   | lname     | dept_id |
+---------+-----------+---------+
| Michael | Smith     |       3 |
| Susan   | Hawthorne |       1 |
| John    | Gooding   |       2 |
+---------+-----------+---------+
```

```
mysql> select * from department;
+---------+----------------+
| dept_id | name           |
+---------+----------------+
|       1 | Operations     |
|       3 | Administration |
+---------+----------------+
```

Suppose we execute the query:

```
SELECT e.fname, e.lname, d.name
FROM employee e
LEFT OUTER JOIN department d
on e.dept_id = d.dept_id;
```

This is one row from the result set:

```
+---------+-----------+-----------------+
| fname   | lname     | name            |
+---------+-----------+-----------------+
| John    | Gooding   | ??????????????? |
+---------+-----------+-----------------+
```

What is ????????????????

A. <Blank>

B. `NULL`

C. `0`

D. N/A. The query is syntactically incorrect and results in an error.

Quiz Question 3

```
mysql> select * from employee;
+--------+----------+-----------+-----------------+
| emp_id | fname    | lname     | superior_emp_id |
+--------+----------+-----------+-----------------+
|      1 | Michael  | Smith     |            NULL |
|      2 | Susan    | Barker    |               1 |
|      3 | Robert   | Tyler     |               1 |
|      4 | Susan    | Hawthorne |               3 |
+--------+----------+-----------+-----------------+
```

Query 1

```
SELECT * FROM employee e
INNER JOIN employee emgr
WHERE e.superior_emp_id = emgr.emp_id;
```

Query 2:

```
SELECT * FROM employee e
LEFT OUTER JOIN employee emgr
ON e.superior_emp_id = emgr.emp_id;
```

Select the best answer.

A. Query 1 returns more rows than Query 2.
B. Query 2 returns more rows than Query 1.
C. Query 1 and Query 2 both return the same number of rows.
D. Either Query 1 or Query 2 (or both) are syntactically incorrect.

Quiz Question 4

What happens when you perform a `NATURAL JOIN` on two tables with no identical column names?

A. It is equivalent to performing an `INNER JOIN`
B. It is equivalent to performing a `LEFT OUTER JOIN`
C. It is equivalent to performing a `RIGHT OUTER JOIN`
D. It is equivalent to performing a Cartesian product or `CROSS JOIN`
E. None of the above

Quiz Question 5

Consider the following queries on some table `Foo` with column `val`:

Q1: `SELECT * FROM Foo a INNER JOIN Foo b WHERE a.val = b.val;`
Q2: `SELECT * FROM Foo a LEFT OUTER JOIN Foo b ON a.val = b.val;`
Q3: `SELECT * FROM Foo a RIGHT OUTER JOIN Foo b ON a.val = b.val;`

Which of the following statements is true?

A. The number of rows from Q1 is always > the number of rows from Q2
B. The number of rows from Q1 is always > the number of rows from Q3
C. The number of rows from Q2 is always > the number of rows from Q3
D. The number of rows from Q3 is always > the number of rows from Q2
E. None of the above

Concept Question 1

Here is a view of the bank schema from our book. From this diagram, what can you tell about the relationship between a customer, an individual, and a business?

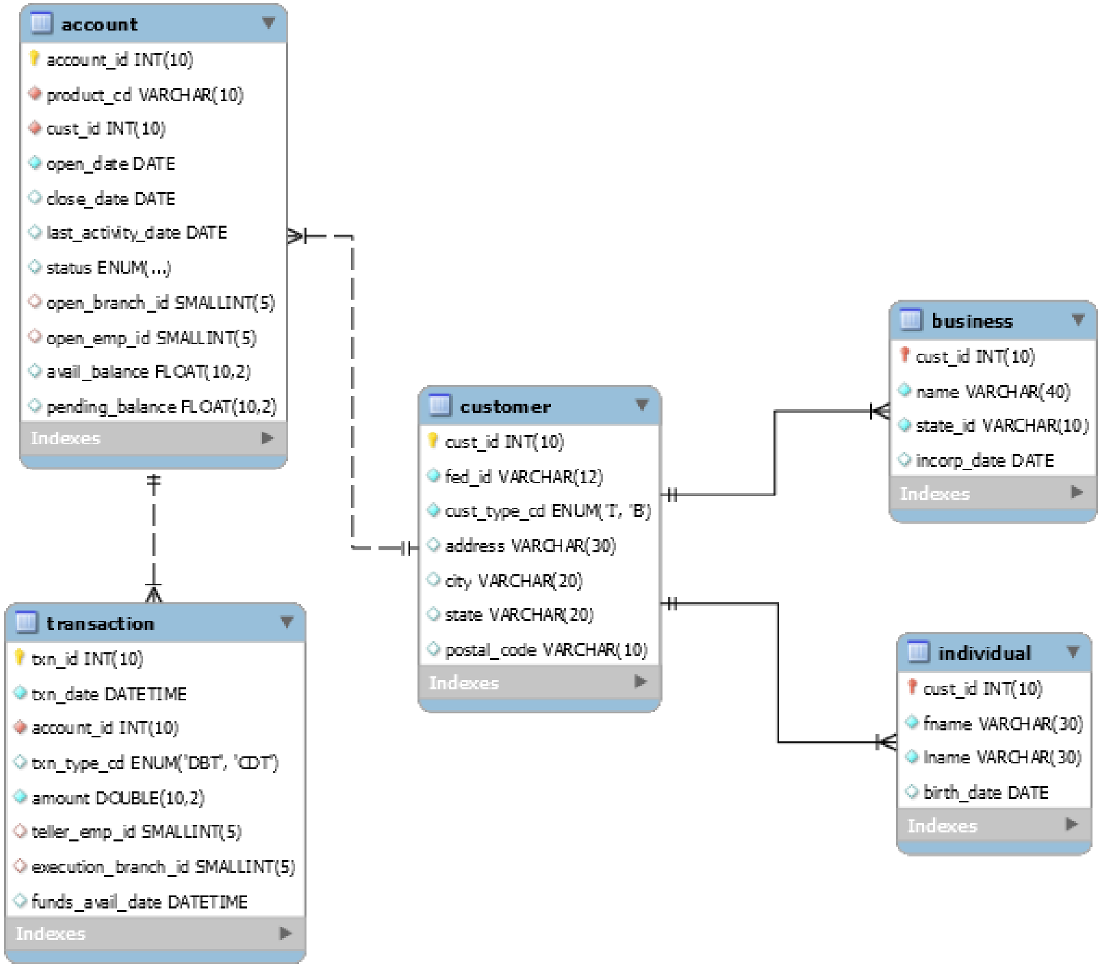
A. A customer is one or more individuals

B. A customer is one or more businesses

C. A customer is either one or more individuals or one or more businesses

D. A customer is either a single business or a single individual

E. None of the above



Concept Question 2

How can we extend the bank schema to support a **joint** account that is owned by multiple customers?

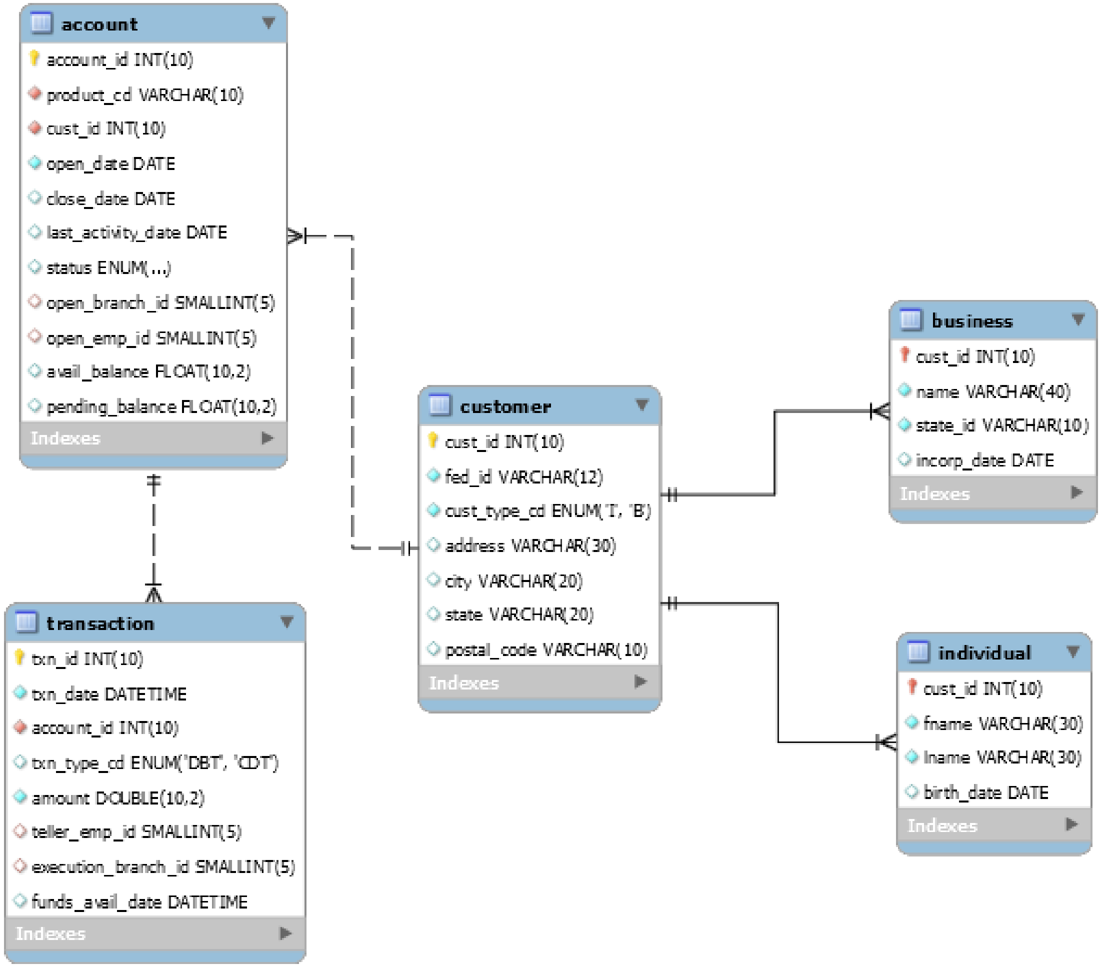
A. Model **account** and **customer** tables as many-to-many with junction table

B. Combine **customer** and **individual** tables

C. Combine **account** and **customer** tables

D. Model **customer** and **individual** tables as many-to-many with junction table

E. Model **customer** and **business** tables as many-to-many with junction table



account
- account_id INT(10)
- product_cd VARCHAR(10)
- cust_id INT(10)
- open_date DATE
- close_date DATE
- last_activity_date DATE
- status ENUM(...)
- open_branch_id SMALLINT(5)
- open_emp_id SMALLINT(5)
- avail_balance FLOAT(10,2)
- pending_balance FLOAT(10,2)
- Indexes

customer
- cust_id INT(10)
- fed_id VARCHAR(12)
- cust_type_cd ENUM('I', 'B')
- address VARCHAR(30)
- city VARCHAR(20)
- state VARCHAR(20)
- postal_code VARCHAR(10)
- Indexes

business
- cust_id INT(10)
- name VARCHAR(40)
- state_id VARCHAR(10)
- incorp_date DATE
- Indexes

transaction
- txn_id INT(10)
- txn_date DATETIME
- account_id INT(10)
- txn_type_cd ENUM('DBT', 'CDT')
- amount DOUBLE(10,2)
- teller_emp_id SMALLINT(5)
- execution_branch_id SMALLINT(5)
- funds_avail_date DATETIME
- Indexes

individual
- cust_id INT(10)
- fname VARCHAR(30)
- lname VARCHAR(30)
- birth_date DATE
- Indexes

Solution for Concept 2

New table definitions:

```
create table account(
  account_id INT(10) primary key AUTO_INCREMENT,
  product_cd VARCHAR(10) NOT NULL,
  ~~cust_id INT(10) NOT NULL,~~
  open_date DATE NOT NULL,
  close_date DATE DEFAULT NULL,
  ... )

CREATE TABLE customer(
  cust_id INT(10) primary key AUTO_INCREMENT,
  fed_id VARCHAR(12) NOT NULL,
  cust_type_cd ENUM('I', 'B') NOT NULL,
  address VARCHAR(30),
  ... )

CREATE TABLE cust_acct(
  acct_id INT(10),
  cust_id INT(10),
  contraint pk_cust_acct primary key (acct_id, cust_id),
  constraint fk_account_id foreign key (acct_id)
     references account (acct_id),
  constraint fk_cust_id foreign key (cust_id)
     references customer (cust_id))
```

Concept Question 3

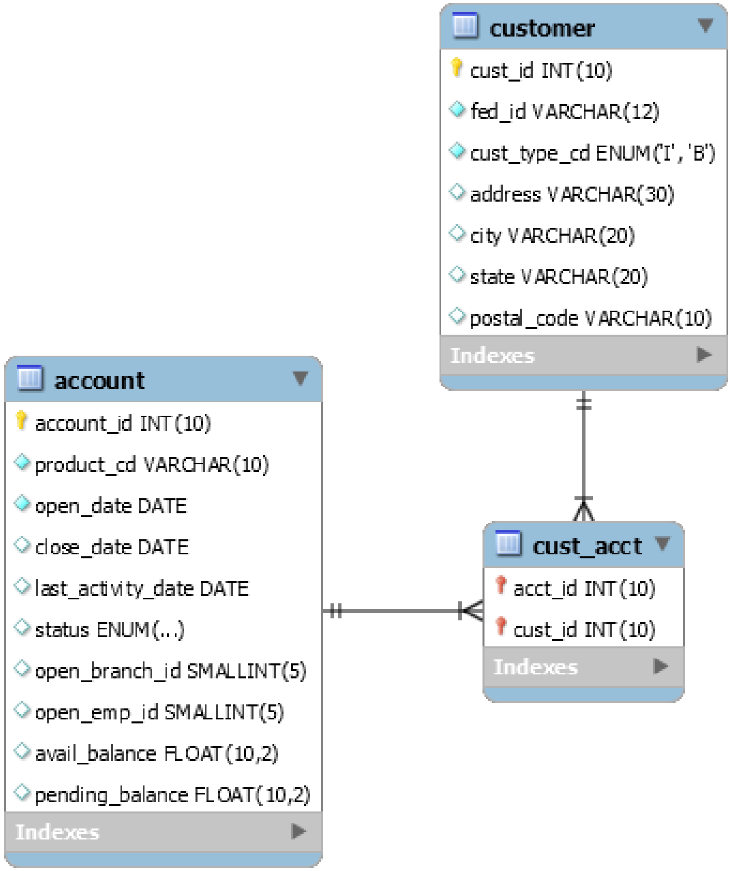
Now that we have established a many-to-many relationship between the `account` and `customer` entities, we need to watch out for “orphan” accounts, namely accounts which belong to no customers. Which of these queries will find all orphan accounts in the bank database?

```
A.  select a.account_id, ca.acct_id
    from account a join cust_acct ca
    on a.account_id = ca.acct_id
    where ca.acct_id is not null

B.  select a.account_id, ca.acct_id
    from account a join cust_acct ca
    on a.account_id = ca.acct_id
    where ca.acct_id is null

C.  select a.account_id, ca.acct_id
    from account a left outer join
    cust_acct ca
    on a.account_id = ca.acct_id
    where ca.acct_id is null

D.  select a.account_id, ca.acct_id
    from account a right outer join
    cust_acct ca
    on a.account_id = ca.acct_id
    where ca.acct_id is null
```



Concept Question 4

The Registrar’s Office needs help finding all current classes that have no students enrolled. Which query will compute this answer?

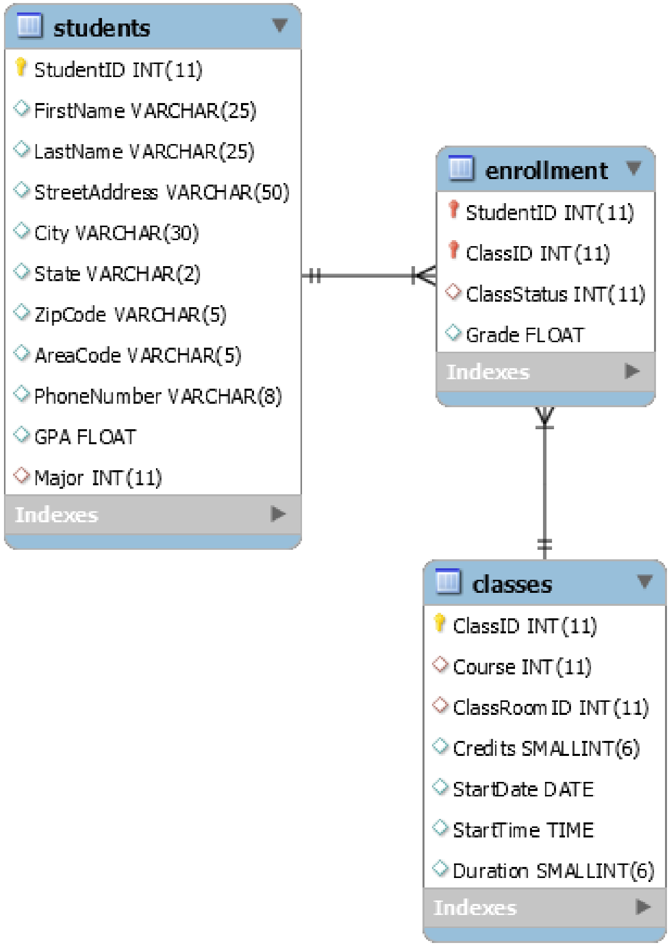
```
A.  select c.ClassID, c.Course
    from enrollment e left outer join classes c
    on e.ClassID = c.ClassID
    where c.ClassID is null
    and c.StartDate = '2016-01-19'

B.  select c.ClassID, c.Course
    from enrollment e right outer join classes c
    on e.ClassID = c.ClassID
    where e.ClassID is null
    and c.StartDate = '2016-01-19'

C.  select c.ClassID, c.Course
    from enrollment e full outer join classes c
    on e.ClassID = c.ClassID
    where c.StartDate = '2016-01-19'

D.  select c.ClassID, c.Course
    from enrollment e join classes c
    on e.ClassID = c.ClassID
    where e.ClassID is null
    and c.StartDate = '2016-01-19'

E.  None of the above
```



Concept Question 5

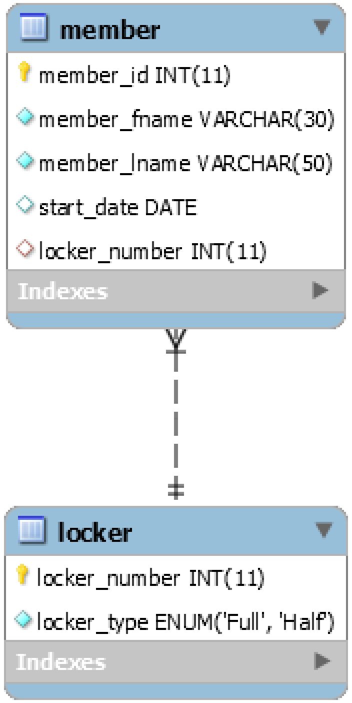
Consider the `Member` and `Locker` tables in the Rec Center's database. Suppose we want to see a list of **all** the members and their assigned locker, including those who have not been assigned to a locker. In the same report, we also want to see a list of **all** the lockers, including those that have not been assigned to a member. What SQL query will compute this answer?

```
A.  select m.member_id, l.locker_number
    from Member m left outer join Locker l
    on m.locker_number = l.locker_number


B.  select m.member_id, l.locker_number
    from Member m right outer join Locker l
    on m.locker_number = l.locker_number


C.  select m.member_id, l.locker_number
    from Member m full outer join Locker l
    on m.locker_number = l.locker_number


D.  select m.member_id, l.locker_number
    from Member m inner join Locker l
    on m.locker_number = l.locker_number
```



member

member_id INT(11)

member_fname VARCHAR(30)

member_lname VARCHAR(50)

start_date DATE

locker_number INT(11)

Indexes

locker

locker_number INT(11)

locker_type ENUM('Full', 'Half')

Indexes

Concept Question 6

The landlord of an apartment complex would like to know who has paid their rent this month. He wants to see a report of all apartment units, tenants, and rent payments, including units with no tenants and tenants who have not paid rent. The time period for the report should be 02/01/16 – 02/08/16.

```
A. select u.unit_nbr, t.tenant_fname,
   t.tenant_lname, rp.payment_date
   from Units u left outer join Tenants t
   on u.unit_nbr = t.unit_nbr
   left outer join RentPayments rp
   on (t.tenant_id = rp.tenant_id
   and u.unit_nbr = rp.unit_nbr)
   where rp.payment_date
   between '2016-02-01' and '2016-02-08'
   or rp.payment_date is null

B. select u.unit_nbr, t.tenant_fname,
   t.tenant_lname, rp.payment_date
   from RentPayments rp
   left outer join Tenants t on
   t.tenant_id = rp.tenant_id
   left outer join Units u
   on (rp.unit_nbr = u.unit_nbr and
   t.unit_nbr = u.unit_nbr)
   where rp.payment_date between '2016-
   02-01' and '2016-02-08'
   or rp.payment_date is null

C. None of the above
```

Table definitions:

```
create table Units(
  unit_nbr integer primary key,
  unit_size double,
  floor integer,
  is_furnished enum('Y', 'N') default 'N',
  rental_price double);

create table Tenants(
  tenant_id integer primary key,
  tenant_fname varchar(30) not null,
  tenant_lname varchar(30) not null,
  move_in_date date,
  move_out_date date,
  vacated_date date,
  unit_nbr integer not null,
  foreign key (unit_nbr) references Units(unit_nbr));

create table RentPayments(
 payment_id integer primary key,
 payment_date date,
 payment_amount double,
 tenant_id integer not null,
 unit_nbr integer not null,
 foreign key (tenant_id) references Tenants(tenant_id),
 foreign key(unit_nbr) references Units(unit_nbr));
```

Concept Question 7

We have a table Credits that represents students and the courses they have taken in college. We would like to see how far each student has gone in his/her degree program. However, a student cannot receive credit for a course until he/she has met the prerequisites for that course. Assume that we have only 3 courses, cs101e, cs102e, and cs103e. Also, assume that cs101e has no pre-requisites, cs102e’s prerequisite is cs101e and cs103e’s prerequisite is cs102e. Which SQL join operators produces the desired output?

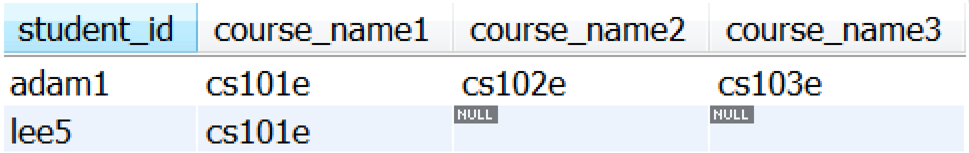
Table definition:

```
create table Credits(
  student_id CHAR(8),
  course_name CHAR(6),
  primary key(student_id, course_name));
```

Sample input:

student_id	course_name
'adam1'	'cs101e'
'adam1'	'cs102e'
'lee5'	'cs101e'
'wsmith'	'cs102e'
'wsmith'	'cs103e'

Desired output:



student_id	course_name1	course_name2	course_name3
adam1	cs101e	cs102e	cs103e
lee5	cs101e	NULL	NULL

A. Single self **inner join** on Credits

B. Single self **outer join** on Credits

C. Chain of two self **outer joins** on Credits

D. Chain of one self **outer join** and one **inner join** on Credits

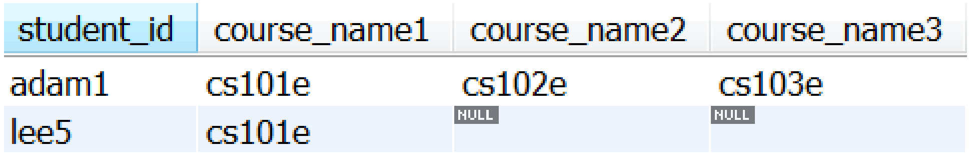
E. Chain of two self **inner joins** on Credits

Solution for Concept 7

SQL Query:

```
select c1.student_id, c1.course_name as course_name1, c2.course_name as
course_name2, c3.course_name as course_name3
from Credits c1 left outer join Credits c2
on (c1.student_id = c2.student_id
    and c1.course_name <> c2.course_name)
left outer join Credits c3
on (c2.student_id = c3.student_id
    and c2.course_name <> c3.course_name)
where c1.course_name = 'cs101e'
and (c2.course_name = 'cs102e' or c2.course_name is null)
and (c3.course_name = 'cs103e' or c2.course_name is null)
```

Desired output:



student_id	course_name1	course_name2	course_name3
adam1	cs101e	cs102e	cs103e
lee5	cs101e	NULL	NULL

Homework for Next Time

- Read chapter 8 from the Learning SQL book
- Exercises at the end of chapter 8