Homework Assignment 3, by 22000546 Yeeun Lee

1.

(a)

If the graph is disconnected, there is no relation between those entities. If the graph has a cycle, there is a relation between all entities in that cycle.

(b)

A weak entity set has no primary key and is dependent on other entities. Instead of the primary key, it has a discriminator to distinguish each record. A strong entity set exists independently, and has a primary key.

(c)

It improves efficiency by separately managing additional information that is not always necessary.

(d)

If there is a null value, it is difficult to call it a lossless decomposition because information loss occurs when joining between relationships.

(e)

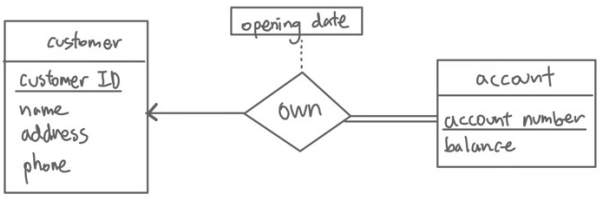
Repetition of information is inefficient in space utilization and in maintaining consistency, so it is a bad relational-database design. *Inability to represent information* is inefficient because unnecessary data must be added to represent necessary information, so it is a bad relational-database design.

(f)

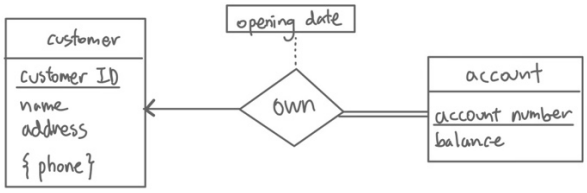
Because it is satisfied by all instances of a relation. When Y is a subset of X, then X → Y is trivial.

2.

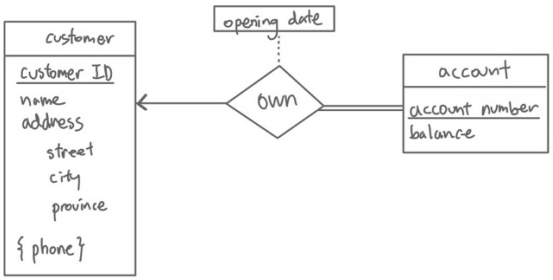
(a)



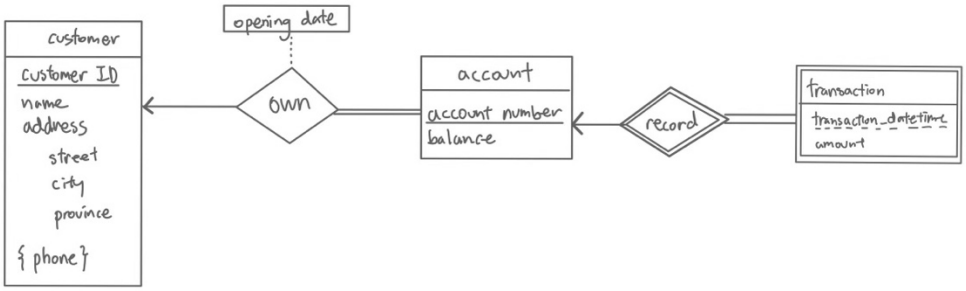
(b)



(c)



(d)



(e)

```
CREATE TABLE customer (
        customer_ID     CHAR(5),
        name            VARCHAR(20),
        street          VARCHAR(20),
        city            VARCHAR(20),
        province        VARCHAR(20),
        PRIMARY KEY(customer_ID));
CREATE TABLE customer_phone (
        customer_ID     CHAR(5),
        phone           VARCHAR(20),
        PRIMARY KEY (customer_ID, phone),
```

```
        FOREIGN KEY (customer_ID) REFERENCES customer);
CREATE TABLE account (
        account_number          CHAR(20),
        balance                 VARCHAR(20),
        customer_ID             CHAR(5),
        opening_date            DATE,
        PRIMARY KEY (account_number, customer_ID),
        FOREIGN KEY (customer_ID) REFERENCES customer);
CREATE TABLE transaction (
        account_number          CHAR(20),
        transaction_datetime    DATETIME,
        amount                  INTEGER,
        PRIMARY KEY (account_number, transaction_datetime),
        FOREIGN KEY (account_number) REFERENCES account);
```

3.

(a)

No. BCNF is a subset of 3NF, so if a relation is in BCNF, then it is in 3NF and it is not sure that if a relation satisfies 3NF, then it is in BCNF. For example, the table below satisfies 3NF, but violates BCNF due to the dependence from teacher to subject.

id	subject	teacher
1	A	t1
1	B	t2
2	C	t3
3	A	t1

(b)

Yes, a relation should be in BCNF before performing 4NF.

(d)

2NF

name depends on *employee_id* and does not depend on key { *employee_id*, *previous_branch* }.
There is a partial dependency.

(e)

2NF

branch_address depends on *branch* and does not depend on key { *employee_id, name, branch* }.
There is a partial dependency.

(f)

3NF

dept_name depends on dept_id, and dept_id is non-PK. There is a transitive dependency.