第一题

Part 1)

Explanation:

R = (A, B, C, D)
B -> AD
A -> B
Find Closure of Left side to find candidate key
B+ -> BAD
B(Not closure)

A+ -> ABD
A(Not closer under R)

BC+ -> BCAD
BC is closure under R

BC Is candidate key (Minimal Super Key)

Prime Attribute -> B, C
Non- Prime Attribute -> A, D

AD is not fully dependent on BC it is partially dependant on B

So not in 2NF

Since, it is not in 2NF it is not in 3NF, and since it is not in 3NF it is not in BCNF

Part 2)

R = (A, B, C, D)
BC -> A
B -> A

To Find Candidate key:
BC+ = BCA (Not Closure)
B+ = BA (Not Closure)
BCD+ = BCDA (Closure)

Prime Attributes : B, C, D

Non-Prime Attributes: A

Prime Attributes are partially dependent on non prime dependent.

Hence, **NOT 2NF, 3NF, BCNF**

Part 3) R = (A, B, C, D)
A -> BCD
D -> A

A+ -> ABCD(Closure under R)

Candidate Key = A
Prime Attribute = A
Non Prime Attributes = BCD

All non prime attributes are fully dependent on Prime Attributes
It is in 2NF

Since there is no Non prime attribute that is determined by another non prime attribute, **it is in 3NF**

A+ -> ABCD
D -> A
D+ -> DABCD
It is int BCNF

Part 4)
R = (A, B, C, D)
No functional dependency are valid in R
There are no non prime attributes thus
IT is in 2NF and 3NF

第二题

(1) Statement Trigger Implementation:

This trigger ensures that a supplier provides products belonging to at most three different categories.

```
CREATE OR REPLACE TRIGGER verify_categories_per_supplier
BEFORE INSERT OR UPDATE ON PRODUCT
FOR EACH ROW
DECLARE
    category_count INTEGER;
BEGIN
    -- Calculate the number of different categories for the supplier
    SELECT COUNT(DISTINCT CATEGORY_NAME) INTO category_count
    FROM PRODUCT
    WHERE SUPPLIER_NAME = :NEW.SUPPLIER_NAME;

    -- Check if the category count exceeds 3
    IF category_count > 3 THEN
        RAISE_APPLICATION_ERROR(-20001, 'A supplier can supply products belonging to at most 3 different categories.');
    END IF;
END;
```

Explanation:
The trigger fires before an INSERT or an UPDATE operation on the PRODUCT table. It counts the distinct number of categories supplied by the supplier of the new or updated product. If the count exceeds three, it raises an application error, thus preventing the operation.

(2) SQL Statements for Extending the Database:

To track the total number of products supplied in each category, you could create a new table or a view. Here, we will create a view:

```
CREATE VIEW CategoryProductCount AS
SELECT CATEGORY_NAME, COUNT(*) AS TOTAL_PRODUCTS
FROM PRODUCT
GROUP BY CATEGORY_NAME;
```

Explanation:
This view calculates the total number of products in each category by grouping the products by their category name and counting them.

(3) Row Trigger Implementation:

This trigger will update the information about the total number of products supplied in each category upon an INSERT or DELETE event.

```
CREATE OR REPLACE TRIGGER update_product_count
AFTER INSERT OR DELETE ON PRODUCT
FOR EACH ROW
BEGIN
    IF INSERTING THEN
        -- Increase the product count for the category
        UPDATE CategoryProductCount
        SET TOTAL_PRODUCTS = TOTAL_PRODUCTS + 1
        WHERE CATEGORY_NAME = :NEW.CATEGORY_NAME;
    ELSIF DELETING THEN
        -- Decrease the product count for the category
        UPDATE CategoryProductCount
        SET TOTAL_PRODUCTS = TOTAL_PRODUCTS - 1
        WHERE CATEGORY_NAME = :OLD.CATEGORY_NAME;
    END IF;
END;
```

Explanation:
This trigger checks whether a row is being inserted or deleted from the PRODUCT table. If a row is inserted, it increments the product count for the corresponding category. If a row is deleted, it decrements the product count.

第五题

(1) Change a city name to Paris and country name to France for all suppliers located in Norway and remove a value of postal code. Next display in a pretty format the company names and postal codes of all suppliers where postal code is associated with null.

(2) Append to a supplier whose company name is Leka Trading information about a new product supplied by the supplier. Include into a description of a new product information about product name, category and unit price. The values associated with the keys are up to you. Next, display all information about the names of products supplied by a supplier Leka Trading.

(3) Remove from a description of supplier whose company name is Gai paturage, information about all products that have unit price greater than 5. Next, display all information about prices of all products supplied by a supplier Gai paturage. Use the methods update(), find(), and pretty() to implement the data manipulations and data retrievals listed above. Write your solutions into the empty slots following a specification of each data manipulation in a file solution2.js. Do not remove the specifications of the data manipulations and semicolons following the specifications. Implementation of each data manipulation is worth 1 mark. When ready create a report from processing of the data manipulations in

the following way. Use gedit editor to open a file solution2.js with the specifications and implementations of the data manipulations. Select the entire contents of the file and Copy it into a buffer. Open a new Terminal window and start mongo client in the following way.