每題二十分·

1. Figure 1 shows a sample of the relation FIRST and Figure 2 shows the FDs for it. Is FIRST in 2NF? What problems should occur with each of the three operations: insert, delete and update? Please suggest a solution to these problems.

2. A **priority queue** is a date structure for maintaining a set S of elements, each with an associated value called a **key**. A priority queue supports the following operations.

   INSERT(S, x) inserts the element x into the set S.

   MAXIMUM(S) returns the element of S with the largest key.

   EXTRACT-MAX(S) removes and returns the element of S with the largest key.

   Please suggest an efficient data structure for priority queue.

3. What is a candidate key? What is a foreign key? Please explain the functions or utilities of candidate keys and foreign keys.

4. Security is a critical problem on network management. Please suggest a approach for network security.

5. What is a *Router*? What is a *Bridge*? What is a *Gateway*? Note: They are network components.

FIRST	S#	STATUS	CITY	P#	QTY
	S1	20	London	P1	300
	S1	20	London	P2	200
	S1	20	London	P3	400
	S1	20	London	P4	200
	S1	20	London	P5	100
	S1	20	London	P6	100
	S2	10	Paris	P1	300
	S2	10	Paris	P2	400
	S3	10	Paris	P2	200
	S4	20	London	P2	200
	S4	20	London	P4	300
	S4	20	London	P5	400

Fig. 1

Fig. 2