Part 1 (60 marks)

Q1 (5 marks: marking scheme P1Q1.pc 2, screenshot 3)

```
[fedora@OracleVM ~]$ ./P2Q1
Connected to ORACLE
Deleting tables:Creating tables:
DROP TABLE Reservation
DROP TABLE Boat          SAMPLE
DROP TABLE Sailer
Finished deleting tables
CREATE TABLE Sailer(S# char (2) PRIMARY KEY,  Name char (20) NOT NULL, Age number(2) DEFAULT 99)
CREATE TABLE Boat(B# char (2)  PRIMARY KEY, Name char (20) UNIQUE, Color char (10))
CREATE TABLE Reservation(S# char (2), B# char (2), Day date, PRIMARY KEY (S#, B#), FOREIGN KEY (S#) R
EFERENCES Sailer (S#) ON DELETE CASCADE,  FOREIGN KEY (B#) REFERENCES Boat (B#) ON DELETE CASCADE)
Finished creating tables
Creation all done
[fedora@OracleVM ~]$ 
```

Q2 (10 marks: P1Q2.pc 5, screenshot 5)

```
[fedora@OracleVM ~]$ ./P2Q2
Connected to ORACLE
There are 3 tables in this db:
1. Sailer
2. Boat
3. Reservation


Please enter number 1, 2 or 3 to select a table or enter q to quit.
1
S#:
S1
Name:
Smith
Age:
20
('q' to quit Sailer table else, other key to continue.)
q
There are 3 tables in db:
1. Sailer
2. Boat
3. Reservation


Please enter a number 1, 2 or 3 to select a table or q to quit.
2
B#:
B1
Name:
Freedom
Color:
Blue
'q' to quit Boat table else, other key to continue.
q
There are 3 tables in db:
1. Sailer
2. Boat
3. Reservation


Please enter a number 1, 2 or 3 to select a table or q to quit.
3
S#:
S1
B#:
B1
Date(1-Jan-15):
1-Jan-15
'q' to quit Reservation table else, other key to continue.)
q
There are 3 tables in db:
1. Sailer
2. Boat
3. Reservation


Please enter a number 1, 2 or 3 to select a table or q to quit.
q
Insertion done!
```

Q3 (15 marks: Lastname not changed 0, P1Q3.pc 5, screenshot 10)

```
[fedora@OracleVM ~]$ ./P3Q3
Connected to ORACLE
+------------------------------------------------------+
| S# |  Name        |  Age                        |
+------------------------------------------------------+
| S1 |  Smith                |  20  |
+------------------------------------------------------+
|  +------------------------------------------+ |
|  |  B#    |  Name      |  Color              | |
|  +------------------------------------------+ |
|  |  B1    |  Freedom            |  Blue      | |      | |
|  +------------------------------------------+ |
|  |  B2    |  Paradise           |  Green     | |      | |
|  +------------------------------------------+ |
|  |  B3    |  Miracle            |  Red       | |      | |
|  +--------------Sample----------------------+ |
+------------------------------------------------------+
| S2 |  Jones                |  30  |
+------------------------------------------------------+
|  +------------------------------------------+ |
|  |  B#    |  Name      |  Color              | |
|  +------------------------------------------+ |
|  |  B1    |  Freedom            |  Blue      | |      | |
|  +------------------------------------------+ |
|  |  B2    |  Paradise           |  Green     | |      | |
|  +------------------------------------------+ |
+------------------------------------------------------+
| S3 |  Lastname             |  25  |
+------------------------------------------------------+
|  +------------------------------------------+ |
|  |  B#    |  Name      |  Color              | |
|  +------------------------------------------+ |
|  |  B1    |  Freedom            |  Blue      | |      | |
|  +------------------------------------------+ |
+------------------------------------------------------+
```

Q4 (20 marks: P1Q4.pc 10, screenshot 10)

```
ALG> project name,age(sailer)
dqlstmt select  name,age from sailer

NAME                 AGE

Smith                 20
Jones                 30
Lastname              25


3 rows processed.
ALG> project name,color(boat)
dqlstmt select  name,color from boat

NAME                 COLOR

Freedom              Blue
Paradise             Green
Miracle              Red


3 rows processed.
ALG> project age(boat)
dqlstmt select  age from boat


ORA-00904: "AGE": invalid identifier

Parse error at character offset 8 in SQL statement.

ALG>
```

```
ALG> select name='Lastname'(sailer)
dqlstmt select  * from sailer where  name='Lastname'

S# NAME                 AGE

S3 Lastname              25


1 row processed.
ALG> select age>20(sailer)
dqlstmt select  * from sailer where  age>20

S# NAME                 AGE

S2 Jones                 30
S3 Lastname              25


2 rows processed.
ALG> select age>20(boat)
dqlstmt select  * from boat where  age>20


ORA-00904: "AGE": invalid identifier

Parse error at character offset 27 in SQL statement.
```

Q5 (10 marks: P1Q5 5, screenshot 5)

```
Sailer
+---------------------------------------------------------+
|S#          |Name              |Age           |
+---------------------------------------------------------+
|S1          |Smith             |20            |
+---------------------------------------------------------+
|   +-------------------------------------------------+ |
|   |B#          |Name              |Color         | |
|   +-------------------------------------------------+ |
|   |B1          |Freedom           |Blue          | |
|   |B2          |Paradise          |Green         | |
|   |B3          |Miracle           |Red           | |
|   +-------------------------------------------------+ |
+---------------------------------------------------------+
|S2          |Jones             |30            |
+---------------------------------------------------------+
|   +-------------------------------------------------+ |
|   |B#          |Name              |Color         | |
|   +-------------------------------------------------+ |
|   |B1          |Freedom           |Blue          | |
|   |B2          |Paradise          |Green         | |
|   +-------------------------------------------------+ |
+---------------------------------------------------------+
|S3          |Lastname          |25            |
+---------------------------------------------------------+
|   +-------------------------------------------------+ |
|   |B#          |Name              |Color         | |
|   +-------------------------------------------------+ |
|   |B1          |Freedom           |Blue          | |
|   +-------------------------------------------------+ |
+---------------------------------------------------------+
PL/SQL procedure successfully completed.
```

Part 2 (40 marks)

1. (10 marks) 2marks each

A	B	C
10	b1	c1
10	b2	c2
11	b4	c1
12	b3	c4
13	b1	c1
14	b3	c4

   (a) $A \rightarrow B$
       No. <10, b1>, <10, b2>
   (b) $B \rightarrow C$
       Yes
   (c) $C \rightarrow B$
       No <c1, b1>, <c1, b4>
   (d) $B \rightarrow A$
       No <b1, 10>, <b1, 13>, <b3, 12>, <b3, 14>
   (e) $C \rightarrow A$
       No <c1, 10>, <c1, 11>, <c1, 13>, <c4, 12>, <c4, 14>
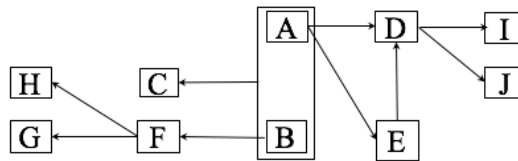
2. (10 marks)

Given a database consisting of one first normal form relation **FIRST** with attributes {A, B, C, D, E, F, G, H, I, J} and the functional dependencies as well as the dependency diagram as follows:

FIRST

A	B	C	D	E	F	G	H	I	J

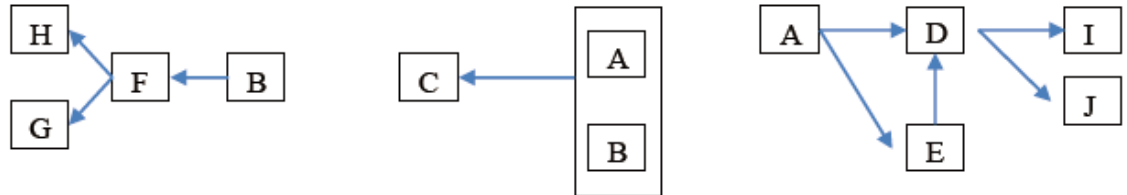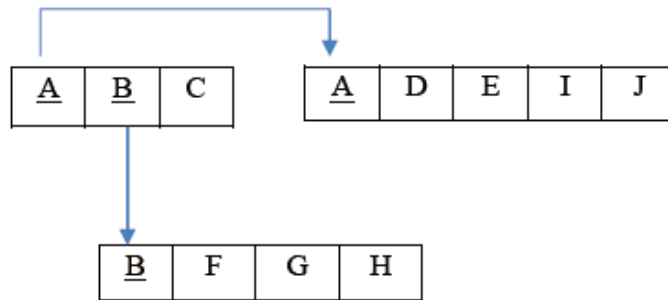**Functional Dependencies**

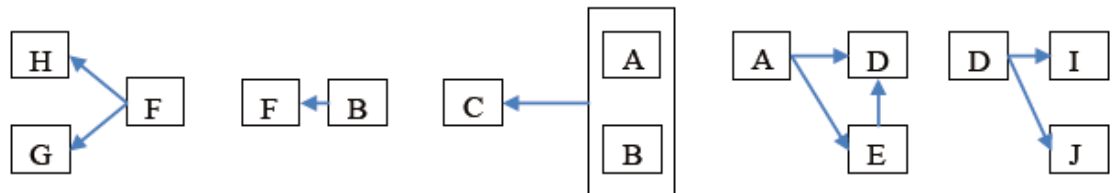{AB → C, A → DE, B → F, E→D, F → GH, D → IJ}

**Dependency Diagram**

(a) What is the key for FIRST? (2 marks)
   AB
(b) Normalize FIRST into second normal form by giving the relation names, their attributes with primary keys underscored and foreign keys pointing to the corresponding attributes properly and its dependency diagrams as showing above (4 marks).
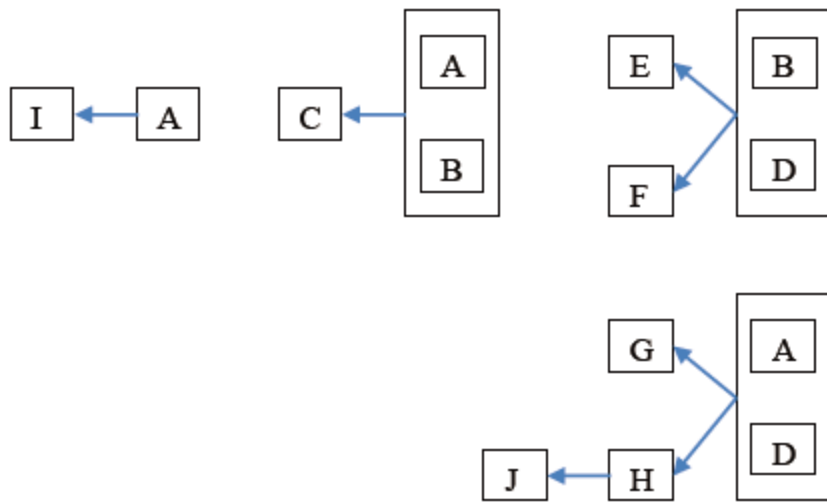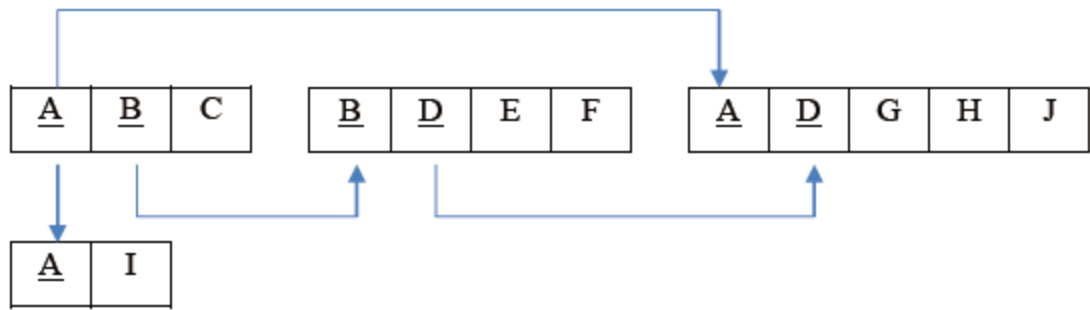
| **A** | **B** | C |

| **A** | D | E | I | J |

| **B** | F | G | H |

H
F ← B
G

C ← A
B

A → D → I
D → E, A → E, E → D, D → J

OR

| **A** | **B** | C |

| **A** | D | E |

| **D** | I | J |

| **B** | F |

| **F** | G | H |

H
F
G ← F ← B

C ← A
B

A → D, A → E, E → D

D → I
D → J
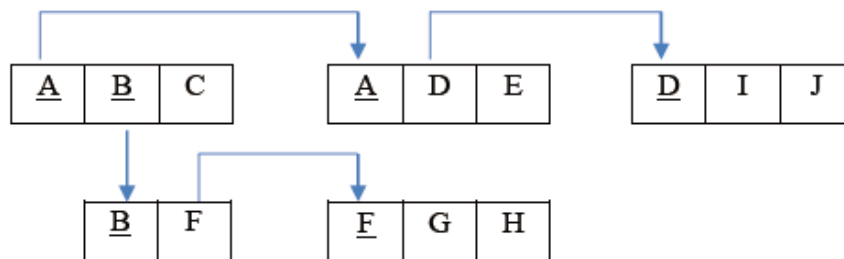
(c) Normalize the result in the second question into the third normal form by giving the relation names, their attributes with primary keys underscored and foreign keys pointing to the corresponding attributes properly and its dependency diagrams as showing above (4 marks).
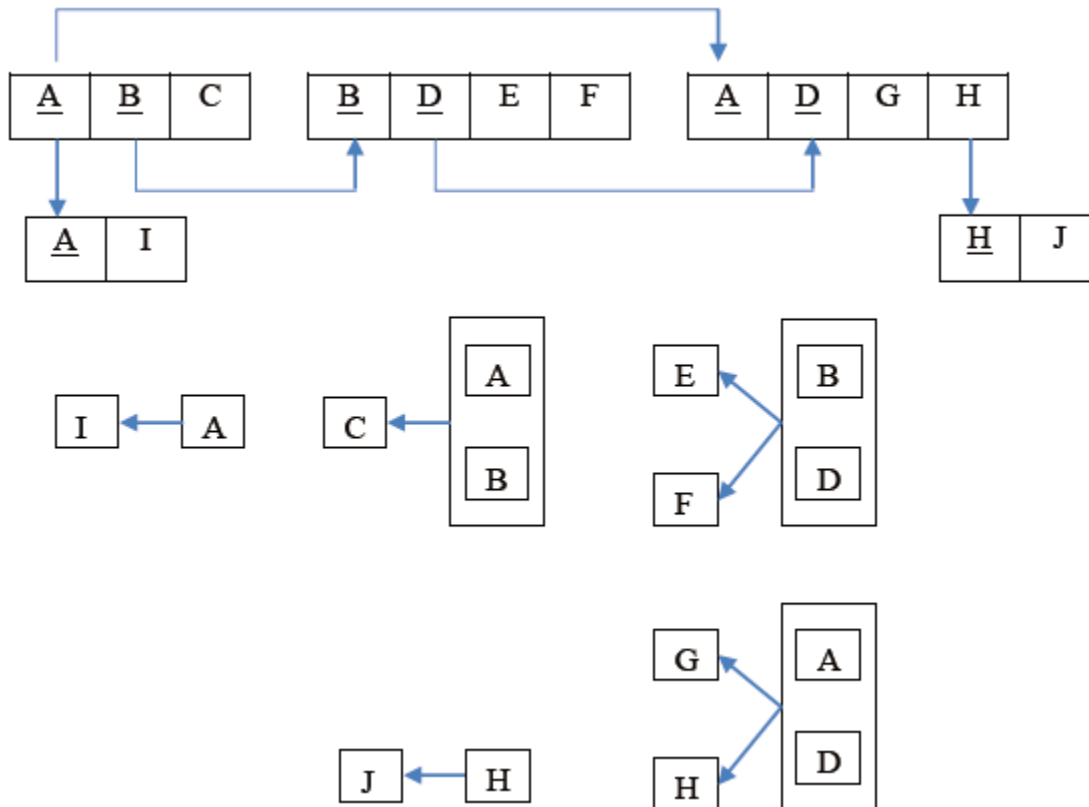
A B C   A E   E D   D I J

B F   F G H

H
F
G

F ← B

C ←

A
B

E → D

A → E

D → I

D → J
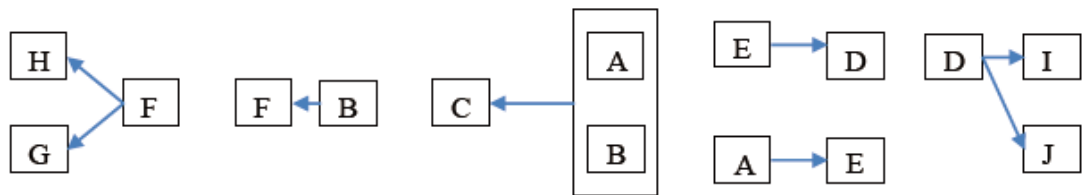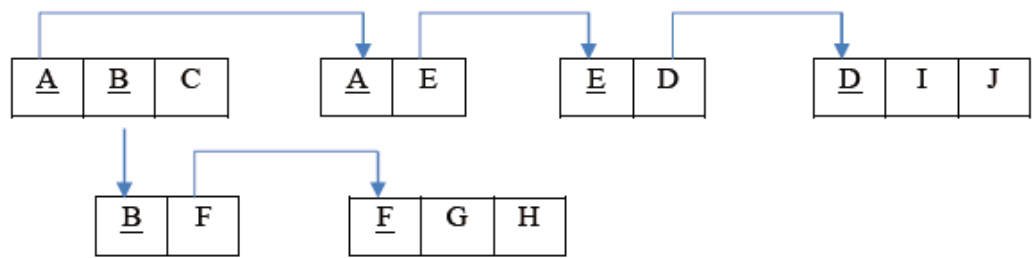
3. (10 Marks)
   Repeat the questions in Part 2 for the following different set of functional
   dependencies: {AB → C, BD → EF, AD → GH, A→I, H → J}.
   (a). (2 marks) ABD
   (b). (4 marks)

(c) (4 marks)

Relation schemas (with primary keys underlined and foreign key references):

A	B	C

B	D	E	F

A	D	G	H

A	I

H	J

Functional dependency diagrams:
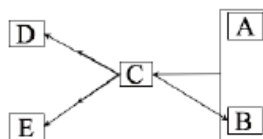
I ← A

C ← { A, B }

E ← B, F ← D

J ← H

G ← A, H ← D

4. (10 marks)
   Given a database consisting of one first normal form relation SECOND with
   attributes A, B, C, D, E, and the functional and multi-valued dependencies as well as
   the functional and the multi-valued dependency diagram as follows:

   SECOND

A	B	C	D	E

   Functional Dependencies {AB → C, C → B}
   Multivalued Dependencies {C →→ D, C→→ E}
   Dependency Diagram

   D ←
   E ←
   C ←
   A
   B

   1. What is the key for SECOND? (2 marks)
      ACDE OR ABDE
   2. What is the highest normal form this relation is in? (2 marks)
      3NF

   3. Normalize the relation into BCNF by giving its relation names, their attributes with
   primary keys underscored and foreign keys pointing to the corresponding attributes
   properly and its dependency diagrams as showing above (3 marks).

C	D	E

C	B

C	A

D

C

E

C

A

B
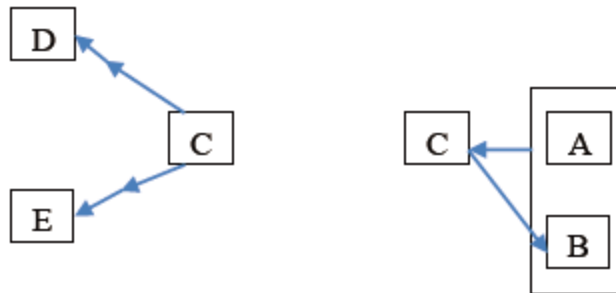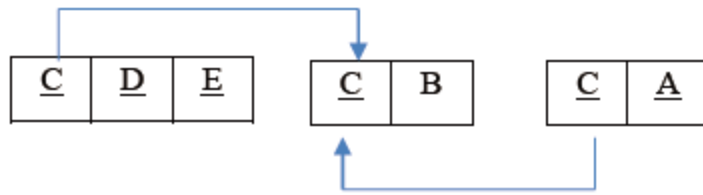
4. Normalize the result in the third question into the fourth normal form by giving its relation names, their attributes with primary keys underscored and foreign keys pointing to the corresponding attributes properly and its dependency diagrams as showing above (3 marks).

C	D

C	E

C	B

C	A

D ← C

E ← C

C

A

B