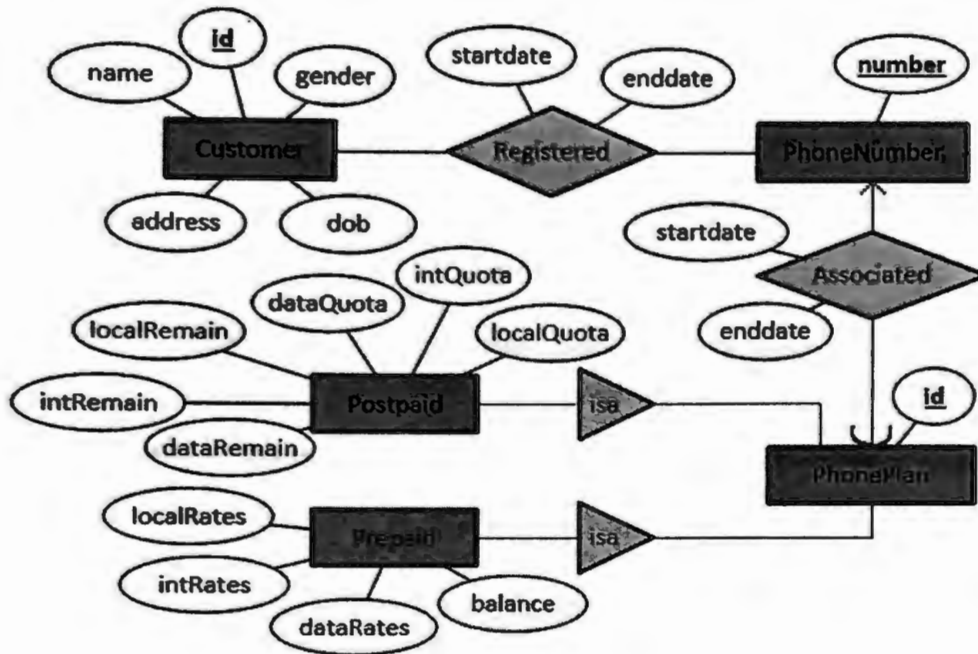


Solver: Thai Nguyen Hung

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1. (a)
(i)



- (ii) Customer (id, name, gender, dob, address)
PhoneNum (number)
Cust_PhoneNum_Registered (cust_id, number, startdate, enddate)
PhonePlan (id)
PhoneNum_PhonePlan_Associated (number, plan_id, startdate, enddate)
Postpaid (plan_id, localQuota, intQuota, dataQuota, localRemain, intRemain, dataRemain)
Prepaid (plan_id, localRates, intRates, dataRates, balance)

(b)

- (i) $R1 := \sigma_{\text{Gender}='Female' \text{ AND } \text{Year} \leq 2015} \text{ACTOR} \bowtie \text{MOVIE} \bowtie \text{ROLE}$
 $R2 := \delta(\Pi_{\text{AName}} R1)$

- (ii) $R1 := \sigma_{\text{Year} \geq 2005 \text{ AND } \text{Year} \leq 2015} \text{ACTOR} \bowtie \text{MOVIE} \bowtie \text{ROLE}$
 $R2 := \gamma_{\text{AName}, \text{SUM}(\text{Pay}) \rightarrow \text{TotalPay}, \text{COUNT}(\text{MID}) \rightarrow \text{NumOfMovies}} R1$

- (iii) $R1 := \text{ACTOR} \bowtie \text{MOVIE} \bowtie \text{ROLE}$
 $R2 := \delta(\Pi_{\text{AName}} R1)$
 $R3 := \delta(\Pi_{\text{AName}} (\sigma_{\text{Profit} \geq 0} R1))$
 $R4 := R3 - R2$

(iv) $R1 \equiv \text{ACTOR} \bowtie \text{MOVIE} \bowtie \text{ROLE}$
 $R2 \equiv \sigma_{\text{Year}=2015} R1$
 $R3 \equiv \gamma_{\text{AName}, \text{SUM}(\text{Pay}) \rightarrow \text{TotalPay}} R2$
 $R4 \equiv \Pi_{\text{AName}} (\sigma_{\text{TotalPay} \geq 1,000,000} R3)$
 $R5 \equiv \gamma_{\text{AName}, \text{COUNT}(\text{MID}) \rightarrow \text{NumOfMovies}} R1$
 $R6 \equiv \Pi_{\text{AName}} (\sigma_{\text{NumOfMovies} \leq 3} R5)$
 $R7 \equiv R4 \cap R6$

2. (a)

A does not appear on the RHS of the FDs; thus, A must be included in the keys

$\{A\}^+ = \{A\}$, $\{AB\}^+ = \{ABC\}$, $\{AC\}^+ = \{AC\}$, $\{AD\}^+ = \{ABCDE\}$
 $\{AE\}^+ = \{ABCDE\}$, $\{ABC\}^+ = \{ABC\}$

So, keys of R: AD, AE

FD $AB \rightarrow C$ violates BCNF definition. $\{AB\}^+ = \{ABC\}$

Decomposition of R: $R1(A, B, C)$; $R2(A, B, D, E)$

Keys of R1: AB. R1 is in BCNF

Keys of R2: AD, AE. FD $BD \rightarrow E$ violates BCNF definition. $\{BD\}^+ = \{BDE\}$

Decomposition of R2: $R3(B, D, E)$; $R4(A, B, D)$

Keys of R3: BD, E. R3 is in BCNF.

Keys of R4: AD, R4 is in BCNF.

Conclusion: the decomposition of R is $R1(A, B, C)$; $R3(B, D, E)$; $R4(A, B, D)$.

All the FDs are reserved.

(b)

FD $AB \rightarrow C$ violates 3NF definition.

Let $S = \{AB \rightarrow C, AD \rightarrow B, BD \rightarrow E, DE \rightarrow B, E \rightarrow D\}$.

We will determine the minimal basis of S.

After the first 2 steps, S remains the same.

After step 3, $S = \{AB \rightarrow C, AD \rightarrow B, BD \rightarrow E, E \rightarrow B, E \rightarrow D\}$

Hence we ended up with the set $S = \{AB \rightarrow C, AD \rightarrow B, BD \rightarrow E, E \rightarrow BD\}$, which gives the 3NF decomposition of R as $R1(A, B, C)$; $R2(A, B, D)$; $R3(B, D, E)$.

3. (a)

No, They do not always produce the same results.

Query 1 gets a list of all patients' id of whom who has never used any item of the form %digoxin%.

Query 2 gets a list of all the patients' id of whom who has at least once used an item differed from the form %digoxin%.

(b)

(i) CREATE VIEW KeyBranch AS
SELECT branchName, city, assets
FROM BRANCH

```
WHERE branchName IN  
  ( SELECT branchName  
    FROM ACCOUNT  
    GROUP BY branchName  
    HAVING SUM(balance) > 1000000 AND COUNT(accountNumber) > 50  
  );
```

```
(ii) CREATE ASSERTION Q3b CHECK (  
  NOT EXISTS (  
    SELECT branchName  
    FROM ACCOUNT NATURAL JOIN BRANCH  
    GROUP BY branchName  
    HAVING SUM(balance) > assets ) );
```

(c)

(i)	
1	1100
2	2200
3	3300
4	4400

(ii)	
1	4400
2	4400
3	4400
4	4400

(d)

String myQuery = "SELECT name" + "FROM Courses" + "WHERE code = " + code; is
lack of spacing in between. The correct one should be
String myQuery = "SELECT name " + "FROM Courses " + "WHERE code = " + code;

4. (a)

```
SELECT Dnum, Dname  
FROM DEPT  
WHERE Dnum IN  
(  
  SELECT DISTINCT Dno  
  FROM  
    (SELECT DNo, AVG(Salary) AS avgsal FROM EMP GROUP BY DNo)
```

WHERE avgsal =

```
(
  SELECT MAX(TMP.avgsal)
  FROM (SELECT DNo, AVG(Salary) AS avgsal FROM EMP GROUP BY DNo) AS TMP
);
```

(b)

(i)

```
<!DOCTYPE result [
  <ELEMENT result                (applicants, choices)>
  <ELEMENT applicants            (applicant+)>
  <ELEMENT applicant            (#PCDATA)>
  <!ATTLIST applicant
    name CDATA #IMPLIED
    appNum ID #REQUIRED>
  <ELEMENT choices              (choice+)>
  <ELEMENT choice                (#PCDATA)>
  <!ATTLIST choice
    applicant IDREF #IMPLIED
    code ID #REQUIRED
    choiceNum CDATA #IMPLIED
    meritScore CDATA #REQUIRED>
]>
```

(ii) <results>

```
  <applicants>
    <applicant name="Doreen" appNum="a1">
      <choice code="MPSOF" choiceNum="1" meritScore="750" />
      <choice code="MPALG" choiceNum="2" meritScore="750" />
      <choice code="MPCSN" choiceNum="3" meritScore="800" />
    </applicant>
    <applicant name="Dilwyn" appNum="a2">
      <choice code="MPALG" choiceNum="1" meritScore="700" />
    </applicant>
    <applicant name="Suzanne" appNum="a3">
      <choice code="MPCSN" choiceNum="1" meritScore="850" />
      <choice code="MPALG" choiceNum="2" meritScore="850" />
    </applicant>
  </applicants>
</results>
```

(c)

(i) `//*[@choiceNum="1"]/[@meritScore>800]`

(ii) `//*[@applicant =//*[@name="Doreen"]/@appNum]/@code`