**韦覃子茜 2020011395**

I.

1. The functional dependencies are as following:

fd1: leaseNo -> bannerID, placeNo, fName, lName, startDate, finishDate, flatNo, flatAddress;

fd2: bannerID ->fName, lName;

fd3: placeNo -> flatNo, flatAddress;

fd4: fName -> lName;

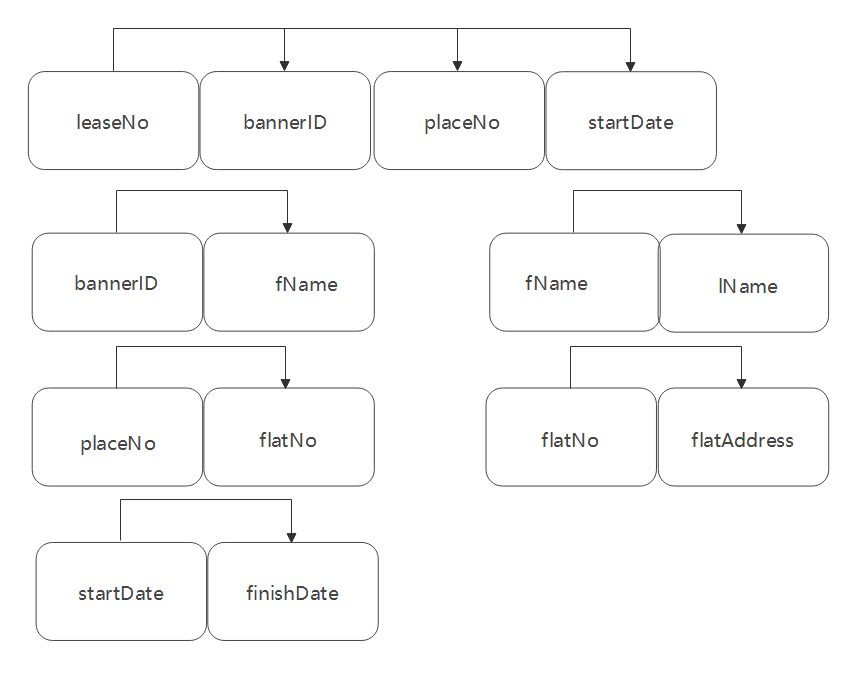
fd5: startDate -> finishDate;

fd6: flatNo -> flatAddress.

Primary key: leaseNo;

Alternate key: (bannerID, placeNo) , (bannerID,flatNo), (bannerID, flatAddress), (fName, placeNo) , (fName,flatNo), (fName, flatAddress), (lName, placeNo) , (lName,flatNo), (lName, flatAddress) etc.

1. The 3NF tables and final relation are as following:



1. the DDL statements are as following:

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| --- |
| CREATE DOMAIN LeaseNo AS VARCHAR(5);  CREATE DOMAIN BannerID AS VARCHAR(7);  CREATE DOMAIN PlaceNo AS SMALLINT;  CREATE DOMAIN PersonName AS VARCHAR(8);  CREATE DOMAIN FlatNo AS CHAR(3);  CREATE DOMAIN Address AS VARCHAR(30);  CREATE TABLE PersonInfo(  fName PersonName,  lName PersonName,  PRIMARY KEY (fName)  );  CREATE TABLE BannerInfo(  bannerID BannerID NOT NULL,  fName PersonName NOT NULL  CHECK (VALUE IN (SELECT fName FROM PersonInfo)),  PRIMARY KEY (bannerID),  FOREIGN KEY (fName) REFERENCES ON PersonInfo ON UPDATE NO ACTION ON DELETE SET NULL  );  CREATE TABLE FlatInfo(  flatNo FlatNo NOT NULL,  flatAddress Address NOT NULL,  PRIMARY KEY (flatNo)  );  CREATE TABLE PlaceInfo(  placeNo PlaceNo NOT NULL,  flatNo FlatNo NOT NULL  CHECK (VALUE IN (SELECT flatNo FROM FlatInfo)),  PRIMARY KEY (placeNo),  FOREIGN KEY (flatNo) REFERENCES ON FlatInfo ON UPDATE CASCADE  );  CREATE TABLE LeaseDate(  startDate DATE NOT NULL,  finishDate DATE NOT NULL  PRIMARY KEY (startDate)  );  CREATE TABLE LeaseInfo(  leaseNo LeaseNo NOT NULL,  bannerID BannerID NOT NULL  CHECK(VALUE IN (SELECT bannerID FROM BannerInfo)),  placeNo PlaceNo NOT NULL  CHECK (VALUE IN (SELECT placeNo FROM PlaceInfo)),  startDate DATE NOT NULL  CHECK (VALUE IN (SELECT startDate FROM leaseDate)),  PRIMARY KEY (leaseNo),  FOREIGN KEY (bannerID) REFERENCES ON BannerInfo ON UPDATE CASCADE,  FOREIGN KEY (placeNo) REFERENCES ON PlaceInfo ON UPDATE CASCADE,  FOREIGN KEY (startDate) REFERENCES ON leaseDate ON UPDATE CASCADE  ); |

II．

1. SQL DDL definition:

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| --drop tables  DROP TABLE IF EXISTS forum\_user CASCADE;  DROP TABLE IF EXISTS article CASCADE;  DROP TABLE IF EXISTS comment CASCADE;  --create tables  CREATE TABLE forum\_user(  username VARCHAR(50),  password VARCHAR(50),  age INTEGER,  location VARCHAR(50),  PRIMARY KEY (username)  );  CREATE TABLE article(  article\_id INTEGER,  title VARCHAR(50),  content VARCHAR(50),  create\_by VARCHAR(50),  create\_at TIMESTAMP,  PRIMARY KEY (article\_id),  FOREIGN KEY (create\_by) REFERENCES forum\_user(username)  );  CREATE TABLE comment(  comment\_id INTEGER,  article\_id INTEGER,  content VARCHAR(50),  create\_by VARCHAR(50),  create\_at TIMESTAMP,  PRIMARY KEY (comment\_id),  FOREIGN KEY (create\_by) REFERENCES forum\_user(username)  FOREIGN FEY (article\_id) REFERENCES article(article\_id) ON DELETE CASCADE  ); |

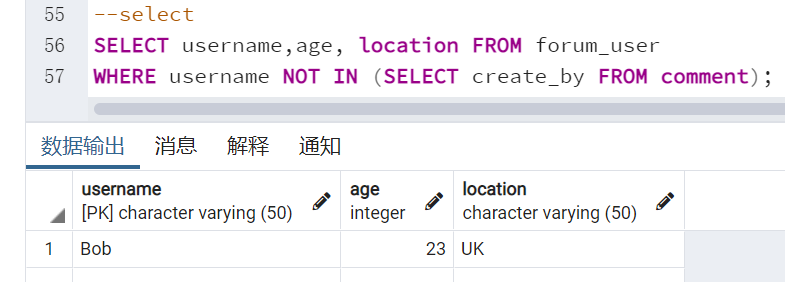
1. Insert data:

|  |
| --- |
| --insert data  INSERT INTO forum\_user(username,password,age, location) VALUES  ('Alice','md5{202cb962ac59075b964b07152d234b70}',20,'USA'),  ('Bob','md5{250cf8b51c773f3f8dc8b4be867a9a02}',23,'UK'),  ('David','md5{68053af2923e00204c3ca7c6a3150cf7}',45,'USA'),  ('John','md5{d2490f048dc3b77a457e3e450ab4eb38}',32,'Canada');    INSERT INTO article(article\_id,title,content,create\_by,create\_at) VALUES  (1,'Homework','It is easy!','David','2020-03-16 08:58:00'),  (2,'Busy','I want more time.','Bob','2020-03-14 12:32:00'),  (3,'Hello','This is my first article.','John','2020-03-10 09:13:00'),  (4,'No Title','No Content.','John','2020-03-15 10:34:00');    INSERT INTO comment(comment\_id,article\_id,content,create\_by,create\_at) VALUES  (1,1,'Are you kidding?','Alice','2020-03-16 08:59:00'),  (2,2,'Me too.','Alice','2020-03-14 12:40:00'),  (3,3,'Welcome!','Alice','2020-03-11 01:03:00'),  (4,4,'What?','Alice','2020-03-15 10:38:00'),  (5,1,'I don''t think so!','John','2020-03-16 09:05:00'),  (6,2,'I have time~','David','2020-03-14 13:12:00'); |

1. codes are as following:

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| --- |
| SELECT username, age, location FROM forum\_user  WHERE username NOT IN (SELECT create\_by FROM comment); |

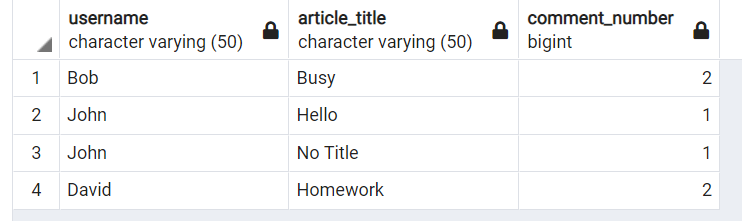
Result:



1. codes are as following:

|  |
| --- |
| SELECT forum\_user.username AS username,article.title AS article\_title,COUNT (comment.comment\_id)AS comment\_number  FROM forum\_user,article, comment  WHERE forum\_user.username=article.create\_by AND article.article\_id=comment.article\_id  GROUP BY forum\_user.username,article.article\_id  ORDER BY forum\_user.age ASC,comment\_number DESC |

Result:



1. codes are as following:

|  |
| --- |
| SELECT create\_by AS username FROM comment  GROUP BY create\_by  HAVING COUNT(DISTINCT article\_id)=(SELECT COUNT(article\_id)FROM article); |

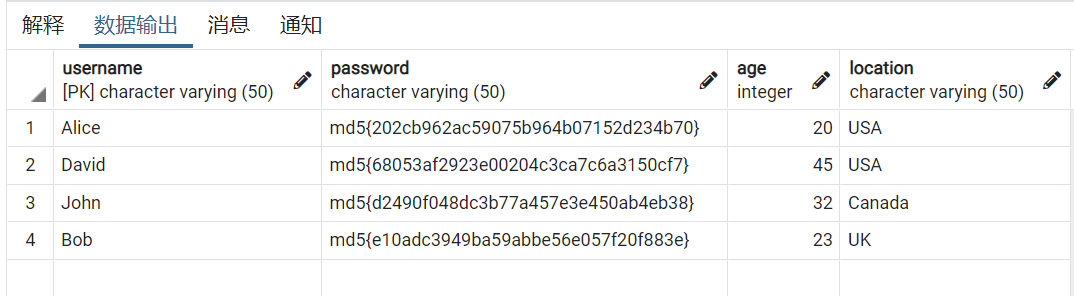
Result:



1. codes are as following:

|  |
| --- |
| UPDATE forum\_user SET password='md5{e10adc3949ba59abbe56e057f20f883e}'  WHERE username='Bob'; |

Result:



1. codes are as following:

|  |
| --- |
| DELETE FROM article  WHERE create\_at=(SELECT MIN(create\_at) FROM article WHERE create\_by='John'); |

Results:

