数据库系统及应用实验报告-Lab02

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>
> 实验： Database Design
>
> 实验环境：
>
> - DBMS: Oracle18.3
> - IDE: PowerDesigner® v16.5

实验内容

某银行准备开发一个银行业务管理系统，通过调查，得到以下的主要需求：

1. 银行有多个支行。各个支行位于某个城市，每个支行有唯一的名字。银行要监控每个支行的资产。
2. 银行的客户通过其身份证号来标识。银行存储每个客户的姓名、联系电话以及家庭住址。为了安全起见，银行还要求客户提供一位联系人的信息，包括联系人姓名、手机号、Email 以及与客户的关系。
3. 客户可以有帐户，并且可以贷款。
4. 客户可能和某个银行员工发生联系，该员工是此客户的贷款负责人或银行帐户负责人。
5. 银行员工也通过身份证号来标识。员工分为部门经理和普通员工，每个部门经理都负责领导其所在部门的员工，并且每个员工只允许在一个部门内工作。每个支行的管理机构存储每个员工的姓名、电话号码、家庭地址、所在的部门号、部门名称、部门类型及部门经理的身份证号。银行还需知道每个员工开始工作的日期，由此日期可以推知员工的雇佣期。
6. 银行提供两类帐户——储蓄帐户和支票帐户。 帐户可以由多个客户所共有，一个客户也可开设多个账户，但在一个支行内最多只能开设一个储蓄账户和一个支票账户。
7. 每个帐户被赋以唯一的帐户号。银行记录每个帐户的余额、开户日期、开户的支行名以及每个帐户所有者访问该帐户的最近日期。
8. 另外，每个储蓄帐户有利率和货币类型，且每个支票帐户有透支额。
9. 每笔贷款由某个分支机构发放，能被一个或多个客户所共有。每笔贷款用唯一的贷款号标识。
10. 银行需要知道每笔贷款所贷金额以及逐次支付的情况（银行将贷款分几次付给客户）。虽然贷款号不能唯一标识银行所有为贷款所付的款项，但可以唯一标识为某贷款所付的款项。对每次的付款需要记录日期和金额。

实验设计

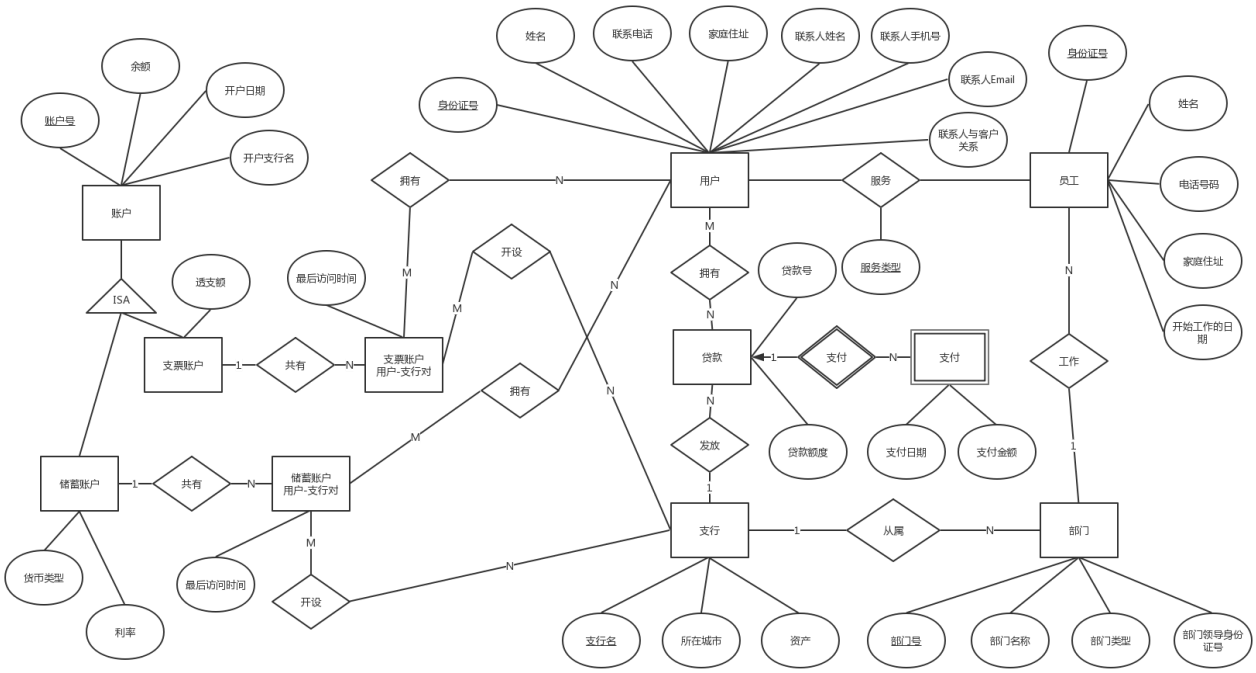
概念模型设计(db_lab2.cdm)

设计思路

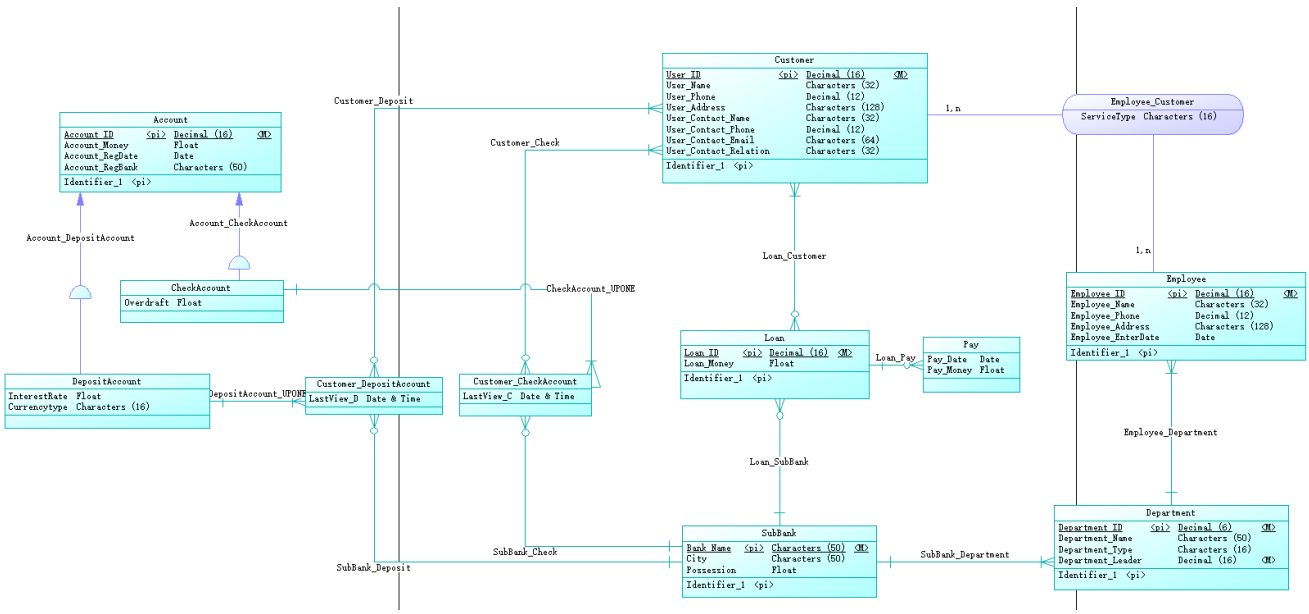
1. 支行是现实实体，并且具有自身性质，所以设计为实体，将支行名作为主键
2. 部门是现实实体，并且具有自身性质，所以设计为实体，将部门编号作为主键，部门对支行的关系是多(部门)对一(支行)
3. 顾客是现实实体，并且具有自身性质，所以设计为实体，将身份证号作为主键
4. 员工是现实实体，并且具有自身性质，所以设计为实体，将身份证号作为主键，员工对部门的关系是多(员工)对一(部门)
5. 客户和员工的关系是多对多，用关系属性表明员工是客户的贷款负责人或银行帐户负责人
6. 因为在这个问题中，*领导*并不具备单独的自身属性，所以不设计为员工实体的子类，而是将领导身份证号作为部门的一个Unique属性

7. 贷款是现实实体，并且具有自身性质，所以设计为实体，将贷款号作为主键，贷款对顾客的关系是多（贷款）对多（顾客），贷款对支行的关系是多（贷款）对一（支行）
8. 支付是依赖于贷款的实体，所以设计为依赖于贷款实体的弱实体
9. 账户是现实实体，并且具有自身性质，所以设计为实体，将账户号作为主键
10. 支票账户是现实实体，属于账户实体，所并且具有自身属性，所以设计为账户的子类
11. 存储账户是现实实体，属于账户实体，所并且具有自身属性，所以设计为账户的子类
12. 为了实现"一个用户在一个支行内最多只能开设一个储蓄账户和一个支票账户"，首先需要一个由用户和支行对应的组合实体，再去和支票账户和储蓄账户做一（账户）对多（组合）的关系，这样每个支票账户或储蓄账户对应的都是不重复的用户和支行组合，就实现了"一个用户在一个支行内最多只能开设一个储蓄账户和一个支票账户"，并且将最近访问日期作为用户和支行组合的属性，实现为每一位用户的每一个账户记录最近访问日期

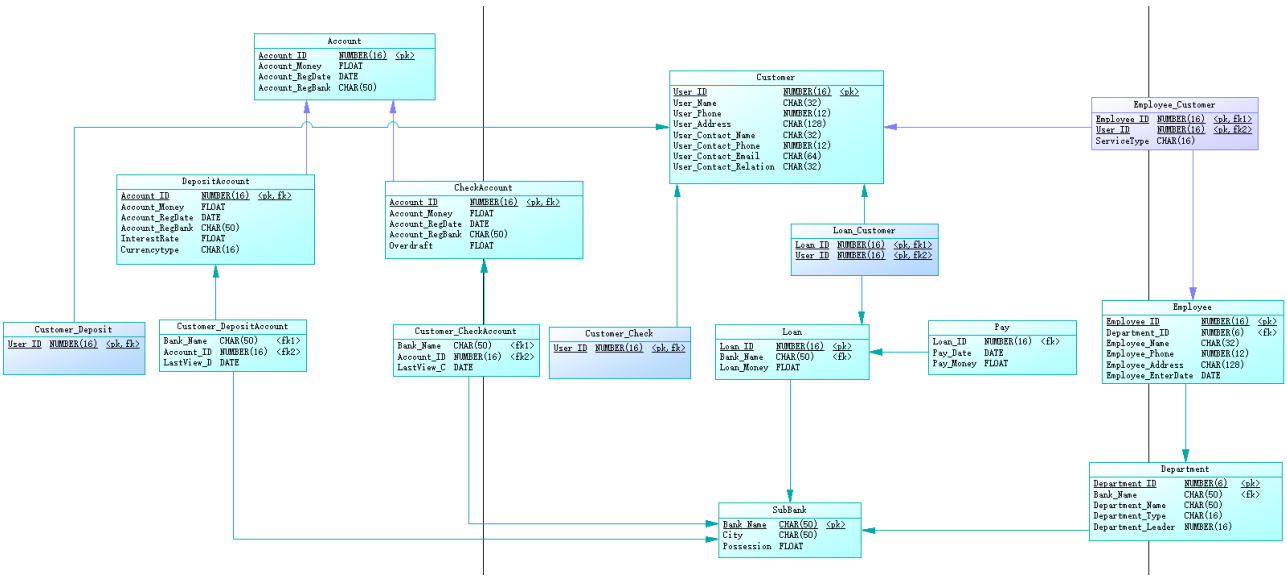
E-R图



具体设计



数据模型生成(db_lab2.pdm)



物理数据库生成(db_lab2.sql)

```sql
/*==============================================================================*/
/* DBMS name:      ORACLE Version 11g                                           */
/* Created on:     2019/5/19 20:33:38                                           */
/*==============================================================================*/


alter table "CheckAccount"
   drop constraint FK_CHECKACC_ACCOUNT_C_ACCOUNT;

alter table "Customer_Check"
   drop constraint FK_CUSTOMER_CUSTOMER_CHECK;

alter table "Customer_CheckAccount"
   drop constraint FK_CUSTOMER_CHECKACCO_CHECKACC;

alter table "Customer_CheckAccount"
   drop constraint FK_CUSTOMER_SUBBANK_C_SUBBANK;

alter table "Customer_Deposit"
   drop constraint FK_CUSTOMER_CUSTOMER_DEPOSIT;

alter table "Customer_DepositAccount"
   drop constraint FK_CUSTOMER_DEPOSITAC_DEPOSITA;

alter table "Customer_DepositAccount"
   drop constraint FK_CUSTOMER_SUBBANK_D_SUBBANK;

alter table "Department"
   drop constraint FK_DEPARTME_SUBBANK_D_SUBBANK;

alter table "DepositAccount"
   drop constraint FK_DEPOSITA_ACCOUNT_D_ACCOUNT;

alter table "Employee"
   drop constraint FK_EMPLOYEE_EMPLOYEE__DEPARTME;
```

```
36
37  alter table "Employee_Customer"
38     drop constraint FK_EMPLOYEE_EMPLOYEE__EMPLOYEE;
39
40  alter table "Employee_Customer"
41     drop constraint FK_EMPLOYEE_EMPLOYEE__CUSTOMER;
42
43  alter table "Loan"
44     drop constraint FK_LOAN_LOAN_SUBB_SUBBANK;
45
46  alter table "Loan_Customer"
47     drop constraint FK_LOAN_CUS_LOAN_CUST_LOAN;
48
49  alter table "Loan_Customer"
50     drop constraint FK_LOAN_CUS_LOAN_CUST_CUSTOMER;
51
52  alter table "Pay"
53     drop constraint FK_PAY_LOAN_PAY_LOAN;
54
55  drop table "Account" cascade constraints;
56
57  drop table "CheckAccount" cascade constraints;
58
59  drop table "Customer" cascade constraints;
60
61  drop table "Customer_Check" cascade constraints;
62
63  drop index "CheckAccount_UPONE_FK";
64
65  drop index "SubBank_Check_FK";
66
67  drop table "Customer_CheckAccount" cascade constraints;
68
69  drop table "Customer_Deposit" cascade constraints;
70
71  drop index "DepositAccount_UPONE_FK";
72
73  drop index "SubBank_Deposit_FK";
74
75  drop table "Customer_DepositAccount" cascade constraints;
76
77  drop index "SubBank_Department_FK";
78
79  drop table "Department" cascade constraints;
80
81  drop table "DepositAccount" cascade constraints;
82
83  drop index "Employee_Department_FK";
84
85  drop table "Employee" cascade constraints;
86
87  drop index "Employee_Customer2_FK";
88
89  drop index "Employee_Customer_FK";
90
91  drop table "Employee_Customer" cascade constraints;
92
93  drop index "Loan_SubBank_FK";
94
95  drop table "Loan" cascade constraints;
```

```
96
97  drop index "Loan_Customer2_FK";
98
99  drop index "Loan_Customer_FK";
100
101 drop table "Loan_Customer" cascade constraints;
102
103 drop index "Loan_Pay_FK";
104
105 drop table "Pay" cascade constraints;
106
107 drop table "SubBank" cascade constraints;
108
109 /*==============================================================*/
110 /* Table: "Account"                                             */
111 /*==============================================================*/
112 create table "Account"
113 (
114    "Account_ID"          NUMBER(16)           not null,
115    "Account_Money"       FLOAT,
116    "Account_RegDate"     DATE,
117    "Account_RegBank"     CHAR(50),
118    constraint PK_ACCOUNT primary key ("Account_ID")
119 );
120
121 /*==============================================================*/
122 /* Table: "CheckAccount"                                        */
123 /*==============================================================*/
124 create table "CheckAccount"
125 (
126    "Account_ID"          NUMBER(16)           not null,
127    "Account_Money"       FLOAT,
128    "Account_RegDate"     DATE,
129    "Account_RegBank"     CHAR(50),
130    "Overdraft"           FLOAT,
131    constraint PK_CHECKACCOUNT primary key ("Account_ID")
132 );
133
134 /*==============================================================*/
135 /* Table: "Customer"                                            */
136 /*==============================================================*/
137 create table "Customer"
138 (
139    "User_ID"             NUMBER(16)           not null,
140    "User_Name"           CHAR(32),
141    "User_Phone"          NUMBER(12),
142    "User_Address"        CHAR(128),
143    "User_Contact_Name"   CHAR(32),
144    "User_Contact_Phone" NUMBER(12),
145    "User_Contact_Email" CHAR(64),
146    "User_Contact_Relation" CHAR(32),
147    constraint PK_CUSTOMER primary key ("User_ID")
148 );
149
150 /*==============================================================*/
151 /* Table: "Customer_Check"                                      */
152 /*==============================================================*/
153 create table "Customer_Check"
154 (
155    "User_ID"             NUMBER(16)           not null,
```

```
   constraint PK_CUSTOMER_CHECK primary key ("User_ID")
);

/*==============================================================*/
/* Table: "Customer_CheckAccount"                               */
/*==============================================================*/
create table "Customer_CheckAccount"
(
   "Bank_Name"          CHAR(50)              not null,
   "Account_ID"         NUMBER(16)            not null,
   "LastView_C"         DATE
);

/*==============================================================*/
/* Index: "SubBank_Check_FK"                                    */
/*==============================================================*/
create index "SubBank_Check_FK" on "Customer_CheckAccount" (
   "Bank_Name" ASC
);

/*==============================================================*/
/* Index: "CheckAccount_UPONE_FK"                               */
/*==============================================================*/
create index "CheckAccount_UPONE_FK" on "Customer_CheckAccount" (
   "Account_ID" ASC
);

/*==============================================================*/
/* Table: "Customer_Deposit"                                    */
/*==============================================================*/
create table "Customer_Deposit"
(
   "User_ID"            NUMBER(16)            not null,
   constraint PK_CUSTOMER_DEPOSIT primary key ("User_ID")
);

/*==============================================================*/
/* Table: "Customer_DepositAccount"                             */
/*==============================================================*/
create table "Customer_DepositAccount"
(
   "Bank_Name"          CHAR(50)              not null,
   "Account_ID"         NUMBER(16)            not null,
   "LastView_D"         DATE
);

/*==============================================================*/
/* Index: "SubBank_Deposit_FK"                                  */
/*==============================================================*/
create index "SubBank_Deposit_FK" on "Customer_DepositAccount" (
   "Bank_Name" ASC
);

/*==============================================================*/
/* Index: "DepositAccount_UPONE_FK"                             */
/*==============================================================*/
create index "DepositAccount_UPONE_FK" on "Customer_DepositAccount" (
   "Account_ID" ASC
);

```

```
/*==============================================================*/
/* Table: "Department"                                          */
/*==============================================================*/
create table "Department"
(
   "Department_ID"      NUMBER(6)             not null,
   "Bank_Name"          CHAR(50)              not null,
   "Department_Name"    CHAR(50),
   "Department_Type"    CHAR(16),
   "Department_Leader"  NUMBER(16)            not null,
   constraint PK_DEPARTMENT primary key ("Department_ID")
);

/*==============================================================*/
/* Index: "SubBank_Department_FK"                               */
/*==============================================================*/
create index "SubBank_Department_FK" on "Department" (
   "Bank_Name" ASC
);

/*==============================================================*/
/* Table: "DepositAccount"                                      */
/*==============================================================*/
create table "DepositAccount"
(
   "Account_ID"         NUMBER(16)            not null,
   "Account_Money"      FLOAT,
   "Account_RegDate"    DATE,
   "Account_RegBank"    CHAR(50),
   "InterestRate"       FLOAT,
   "Currencytype"       CHAR(16),
   constraint PK_DEPOSITACCOUNT primary key ("Account_ID")
);

/*==============================================================*/
/* Table: "Employee"                                            */
/*==============================================================*/
create table "Employee"
(
   "Employee_ID"        NUMBER(16)            not null,
   "Department_ID"      NUMBER(6)             not null,
   "Employee_Name"      CHAR(32),
   "Employee_Phone"     NUMBER(12),
   "Employee_Address"   CHAR(128),
   "Employee_EnterDate" DATE,
   constraint PK_EMPLOYEE primary key ("Employee_ID")
);

/*==============================================================*/
/* Index: "Employee_Department_FK"                              */
/*==============================================================*/
create index "Employee_Department_FK" on "Employee" (
   "Department_ID" ASC
);

/*==============================================================*/
/* Table: "Employee_Customer"                                   */
/*==============================================================*/
create table "Employee_Customer"
(
```

```
    "Employee_ID"        NUMBER(16)            not null,
    "User_ID"            NUMBER(16)            not null,
    "ServiceType"        CHAR(16),
    constraint PK_EMPLOYEE_CUSTOMER primary key ("Employee_ID", "User_ID")
);

/*==============================================================*/
/* Index: "Employee_Customer_FK"                                */
/*==============================================================*/
create index "Employee_Customer_FK" on "Employee_Customer" (
   "Employee_ID" ASC
);

/*==============================================================*/
/* Index: "Employee_Customer2_FK"                               */
/*==============================================================*/
create index "Employee_Customer2_FK" on "Employee_Customer" (
   "User_ID" ASC
);

/*==============================================================*/
/* Table: "Loan"                                                */
/*==============================================================*/
create table "Loan"
(
   "Loan_ID"            NUMBER(16)            not null,
   "Bank_Name"          CHAR(50)              not null,
   "Loan_Money"         FLOAT,
   constraint PK_LOAN primary key ("Loan_ID")
);

/*==============================================================*/
/* Index: "Loan_SubBank_FK"                                     */
/*==============================================================*/
create index "Loan_SubBank_FK" on "Loan" (
   "Bank_Name" ASC
);

/*==============================================================*/
/* Table: "Loan_Customer"                                       */
/*==============================================================*/
create table "Loan_Customer"
(
   "Loan_ID"            NUMBER(16)            not null,
   "User_ID"            NUMBER(16)            not null,
   constraint PK_LOAN_CUSTOMER primary key ("Loan_ID", "User_ID")
);

/*==============================================================*/
/* Index: "Loan_Customer_FK"                                    */
/*==============================================================*/
create index "Loan_Customer_FK" on "Loan_Customer" (
   "Loan_ID" ASC
);

/*==============================================================*/
/* Index: "Loan_Customer2_FK"                                   */
/*==============================================================*/
create index "Loan_Customer2_FK" on "Loan_Customer" (
   "User_ID" ASC
```

```
);

/*==============================================================*/
/* Table: "Pay"                                                 */
/*==============================================================*/
create table "Pay"
(
   "Loan_ID"            NUMBER(16)           not null,
   "Pay_Date"           DATE,
   "Pay_Money"          FLOAT
);

/*==============================================================*/
/* Index: "Loan_Pay_FK"                                         */
/*==============================================================*/
create index "Loan_Pay_FK" on "Pay" (
   "Loan_ID" ASC
);

/*==============================================================*/
/* Table: "SubBank"                                             */
/*==============================================================*/
create table "SubBank"
(
   "Bank_Name"          CHAR(50)             not null,
   "City"               CHAR(50),
   "Possession"         FLOAT,
   constraint PK_SUBBANK primary key ("Bank_Name")
);

alter table "CheckAccount"
   add constraint FK_CHECKACC_ACCOUNT_C_ACCOUNT foreign key ("Account_ID")
      references "Account" ("Account_ID");

alter table "Customer_Check"
   add constraint FK_CUSTOMER_CUSTOMER_CHECK foreign key ("User_ID")
      references "Customer" ("User_ID");

alter table "Customer_CheckAccount"
   add constraint FK_CUSTOMER_CHECKACCO_CHECKACC foreign key ("Account_ID")
      references "CheckAccount" ("Account_ID");

alter table "Customer_CheckAccount"
   add constraint FK_CUSTOMER_SUBBANK_C_SUBBANK foreign key ("Bank_Name")
      references "SubBank" ("Bank_Name");

alter table "Customer_Deposit"
   add constraint FK_CUSTOMER_CUSTOMER_DEPOSIT foreign key ("User_ID")
      references "Customer" ("User_ID");

alter table "Customer_DepositAccount"
   add constraint FK_CUSTOMER_DEPOSITAC_DEPOSITA foreign key ("Account_ID")
      references "DepositAccount" ("Account_ID");

alter table "Customer_DepositAccount"
   add constraint FK_CUSTOMER_SUBBANK_D_SUBBANK foreign key ("Bank_Name")
      references "SubBank" ("Bank_Name");

alter table "Department"
   add constraint FK_DEPARTME_SUBBANK_D_SUBBANK foreign key ("Bank_Name")
```

```
396         references "SubBank" ("Bank_Name");
397
398   alter table "DepositAccount"
399      add constraint FK_DEPOSITA_ACCOUNT_D_ACCOUNT foreign key ("Account_ID")
400         references "Account" ("Account_ID");
401
402   alter table "Employee"
403      add constraint FK_EMPLOYEE_EMPLOYEE__DEPARTME foreign key ("Department_ID")
404         references "Department" ("Department_ID");
405
406   alter table "Employee_Customer"
407      add constraint FK_EMPLOYEE_EMPLOYEE__EMPLOYEE foreign key ("Employee_ID")
408         references "Employee" ("Employee_ID");
409
410   alter table "Employee_Customer"
411      add constraint FK_EMPLOYEE_EMPLOYEE__CUSTOMER foreign key ("User_ID")
412         references "Customer" ("User_ID");
413
414   alter table "Loan"
415      add constraint FK_LOAN_LOAN_SUBB_SUBBANK foreign key ("Bank_Name")
416         references "SubBank" ("Bank_Name");
417
418   alter table "Loan_Customer"
419      add constraint FK_LOAN_CUS_LOAN_CUST_LOAN foreign key ("Loan_ID")
420         references "Loan" ("Loan_ID");
421
422   alter table "Loan_Customer"
423      add constraint FK_LOAN_CUS_LOAN_CUST_CUSTOMER foreign key ("User_ID")
424         references "Customer" ("User_ID");
425
426   alter table "Pay"
427      add constraint FK_PAY_LOAN_PAY_LOAN foreign key ("Loan_ID")
428         references "Loan" ("Loan_ID");
```