Banking Management System and Database

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I. Requirement Analysis

Introduction

Purpose

This banking management system and database will keep track of information important for both internal management of the bank as well as management of the customer's banking. It keeps employee, branch, client, and account data. Employees manage the accounts of customers; customers can own accounts, borrow and pay off loans, and book financial appointments.

A database system like this is crucial to the efficient running and managing of a bank as well as for implementing security, preventing any fraudulent activity, and providing information to trace any suspicious activity that does occur. Beyond keeping records of transactions on accounts, we keep track of the activity on employees on accounts as well as appointments between clients and employees.

Terminology

- Government registration number: a numerical identifier assigned to each business that is registered with the government to simplify identification of dealings between public and private bodies.
- Minimum balance: a set amount for each bank account such that the remaining balance cannot be lower than this amount at any point in time, otherwise there will be a charge.

Scope and Special Requirements

In terms of the many financial products that a bank offers, this model is only concerned with bank accounts and loans. It does not deal with credit cards, investments, or insurance. We also decided to keep it to a local scope (not dealing with foreign accounts or exchange rates). A special requirement is that we do not allow for joint accounts (an account can only be owned by one client).

Database Description

Entities

Clients: A client is a customer of the bank receiving or benefitting from the bank's financial services. A client must be either a personal client or a business client (*covering constraint*) and can only be one of the two (*overlapping constraint*). A client has the following attributes: client ID, name, address, email address, and telephone number. Client ID is the primary key.
Personal: A personal client IS-A client and inherits client's attributes in addition to the following: SIN, gender, date of birth, and occupation.
Business: A business client IS-A client and inherits client's attributes in addition to the following: government registration number, size, start date, and type.
Employees: An employee is a person employed by the bank and has the following attributes: employee ID, name, gender, date of birth, department, and telephone number. Employee ID is the primary key.
Appointments: An appointment is a meeting between a client and an employee to discuss and manage the client's business with the bank. Its attributes are appointment ID, date, and time, and it has foreign keys client ID and employee ID. The primary key is the appointment ID. This allows us to see a history of meetings between a client and the same employee, or a client and different employees.
Branch: A branch is a specific office/division of the bank that operates locally. It has the following attributes: branch ID, address, and number of employees. The branch ID is the primary key.
Accounts: An account is an arrangement made with the bank whereby a client may deposit and withdraw money (and in some cases be paid interest). It has the following attributes: account number, client ID, interest rate, minimal balance, and monthly fee. The account number is the primary key.
Transactions: A transaction is either a withdrawal or a deposit into an account (weak entity). Its attributes are the following: transaction ID, amount, date, type, and description. The partial key is the transaction ID as it is only unique within a given account - not across all accounts
Loans: A loan is an amount of money borrowed by the client from the bank to be paid back with interest. It has the following attributes: loan ID, interest rate, due date, and amount. The primary key is the loan ID.
Payments: A payment is made by a client to pay back the bank for his or her loan (weak entity). It has the following attributes: payment number, amount, and date. The partial key is the payment number, as it is only unique within a given loan, not across all loans.
Records: A record keeps track of an employee's management of a client's account. It has the following attributes: record ID, date, and comment (i.e. change of interest rate, open or close account, etc). The primary key is the record ID. This allows us to keep a history of how accounts are being managed by employees - not just the most recent account activity.

Relationships

Owns: A client *owns* an account - a one-to-many relationship since a client can own many accounts, but an account can only be owned by one client (we assume no joint accounts).
Works for: An employee *works for* another employee. This is a one-to-many relationship since a supervisor may manage many subordinates, but a subordinate may only have one supervisor.
Manages: Employees *manage* accounts. This is a ternary relationship with both key and participation constraints. A record must be associated with exactly one client and one employee.
Books: An appointment is booked between an employee and a client. This is a ternary relationship with both key and participation constraints. An appointment must be associated with exactly one client and exactly one employee.
Located at: An employee is *located at* a branch. This is a one-to-many relationship since an employee can only be located at one branch, while a branch will have many employees located at it.
Associated with: Transactions (weak entity) are *associated with* a particular account. This is a one-to-many relationship since an account may have many transactions associated with it, but a transaction may be associated only with one account.
Borrows: A client *borrows* a loan. This is a one-to-many relationship since a client may borrow many loans, but a loan may only have one client associated with it (two clients cannot take out a loan).
Pays: Payments (weak entity) *pay* loans. This is a one-to-many relationship since a loan can have many payments, but a payment can go toward only one particular loan.

II. E/R Diagram

Please see other attached file.

III. Relations

1) Entity sets:

Clients(clientID, name, address, email, tel_no)

Personal(clientID, gender, date_of_birth, occupation, SIN)(clientID ref Clients)

Business(clientID, start_date, size, type, gov_reg_no)(clientID ref Clients)

Employees(employeeID, name, gender, date_of_birth, department, tel_no, branchID)(branchID ref Branch)

Appointment(appointmentID, employeeID, clientID, date, time)(employeeID ref Employees, clientID ref Clients)

Branch(branchID, address, num_employees)

Accounts(acc_no, clientID, balance, interest_rate, minimum_balance, monthly_fee)(clientID ref Clients)

Transactions(acc_no, transactionID, amount, date, type, description)(acc_no ref Accounts)

Loans(loanID, clientID, interest_rate, amount, due_date)(clientID ref Clients)

Payments(loanID, payment_no, amount, date)(loanID ref Loans)

Records(recordID, employeeID, acc_no, date, comment)(employeeID ref Employees, acc_no ref Accounts)

2) Relations:

Worksfor(supervisorID, subordinateID)(supervisorID ref Employees, subordinateID ref Employees)

Remarks:

- In the relational model, a weak entity set (in this case, Payments and Transactions) and its identifying relationship are modeled within the weak entity set using the key of its identifying entity set (Loans and Accounts, respectively).
- For the one-to-many relationships, we decided not to create separate relations for them, but to use a foreign key to include the relationship in the relation of the entity set with the key constraint, i.e. the “many” in the one-to-many relationship.
- For the Worksfor relationship between the Employees entity set and itself, we rename the attributes accordingly: supervisorID and subordinateID, instead of just using employeeID.

- We feel that it is necessary to have a distinction between Personal clients and Business clients even though they share the same relationships, because they have multiple different attributes.