You need to design a database that will support the operation of a bank. The bank is organized into branches. In a city, there might be several branches. Each branch has a unique name, unique number and address. The bank monitors the assets of each branch. There is only one central branch. Bank customers are identified by their customer ids, which are unique. The bank stores each customer’s name, address (street name, street number and city), birth date, gender, IRD number, home phone number, and business phone number (if available). Customers may have accounts and can take out loans. A customer may be associated with a personal banker. A customer can have at most one account of each type with the bank. An account may be shared by customers, and a customer can have several accounts. There are several types of accounts: savings, checking, credit and loan accounts. Each account has a unique number. The bank maintains a record of each account’s opening day, type, balance and also information about all transactions. For each customer associated with an account, the database should also store the user name for internet access and the chosen password (if appropriate). For each transaction (such as withdrawal or deposit), the database should store the date and time, the amount and the type of transaction. Withdrawals are available from checking and savings accounts, but not from credit cards or loans. For each withdrawal, it is necessary to store the manner in which the withdrawal was made (e.g. teller, ATM machine, or electronic transaction). Each ATM machine has a unique id and location. A deposit can be made via a teller (by cash or cheque) or electronically. If a customer has deposited a cheque, the database should store information about the cheque (unique cheque number, the bank that issued the cheque, the name on the cheque, date and amount).

A customer is issued a bank card, which covers all savings/checking/loan accounts for that customer. Each bank card has a unique number, the date of issue, expiry date and a PIN. There is a daily maximum for each bank card, which is determined by the bank based on the customer’s history. For each account, a statement is issued every month, showing all transactions processed for that account since the previous report. Each report has a report number (within the current year), and shows the names of all customers associated with the account. There are several types of savings accounts, with different interest rates. Each type of savings account has a unique name, the maximal age of the customer (when appropriate), monthly fee, the minimum amount of funds that the account must contain (optionally), the number of free staff-assisted transactions per month, the number of free internet transactions per month, service fee (for using ATM by other banks), overdraft debit interest rate, and a transaction fee. At any time, there will be a number of blank cheques (i.e. a cheque book) issued for each checking account, and the database should store the numbers of issued cheques. A cheque number consists of the account number, plus a cheque number which is unique for that account. When processing a cheque, the database should store the date, the amount and the recipient. A loan account has a unique loan number. The bank keeps track of the loan amount and the loan repayments. The frequency of repayments is known (monthly, weekly or bi-weekly), as well as the minimum amount for repayments. The customer may specify another account (savings or checking) for the loan to be repaid from. Each loan may have a fixed interest, or a floating (variable) interest. The date and amount are recorded for each payment. Interest rates for loans are published weekly by the bank. Bank employees are identified by their staff numbers, which are also unique. The bank administration stores the name (first and last), home and office phone numbers of each employee, as well as the IRD number, gender, birth date, full address, position held and the current salary. The start date of the employment is also stored. Every employee works for a single branch. Each branch has a manager, who has overall responsibility for the management of the branch. Each bank employee is also an account holder, as his/her salary would be deposited into an account. The starting date for the manager is known. Customers may also have credit cards with the bank. The bank issues VISA or MASTER cards. Each card has a unique number, the date of issue and the expiry date. For each credit account, there is a limit (i.e. the maximum amount the customer is allowed to charge to the card), and a maximum amount per transaction. Customers having credit cards get rewards for the total amount spent, which is a certain percentage of the sum of all payments made by the card. Each customer sharing the credit card is charged a yearly fee. Each customer authorized for internet banking can perform the following operations on their accounts: check account balances, move funds between accounts, view and print transactions for a specified time period, and pay bills online. For paying bills online, it is necessary to specify the bank and account number for the receiver, the name of the person or the name of the company the payment is made to, the amount, the date when the payment is to be made (which might be in the future) and a comment to be sent to the receiver (such as invoice number). The database also contains information about registered companies (such as Spark NZ) which payments can be made to. In that case, the customer can simply select one of the registered companies from the list, and only specify the date, amount and the comment to be sent.