ATM Management System Database

Name	Darren Wong
SFSU ID:	918565679
Github ID:	dawong025

Milestone/Version	**Date**
M2V1	4/19/2022
M1V1	3/15/2022

Table of Contents

[Section I] Project Description

Automated Teller Machines (or ATMs) are a staple of today's society. Many ATMs allow a greater range of flexibility for the average user to perform transactions such as deposits, cash withdrawals, or make payments wherever an ATM is. However, the world is trending towards a new age of convenience very rapidly. With this greater desire for convenience and efficiency comes with a greater need to make the world around the ATM better.

The purpose of the ATM Management System Database project seeks to do just that. On the surface, the ATM Management Management System Database will continue to make every day processes like clients using ATM machines as simple and efficient as can be. Behind the scenes, this project seeks to enhance the world around the simple transaction. This includes improving security for users and ensuring that these machines can continue to serve thousands of customers weekly. With this management system, there will be no more vending machine dilemma of having currency not being accepted by the cash slot or a user's card being stuck inside the machine.

Beyond better management of the ATM machine experience, this project seeks to improve the management within the bank as well. This includes an enhanced method of ensuring employees understand their roles and what they bring to the table. For the banking institution itself, it can better manage transactions and operate smoothly on a day-to-day basis.

[Section II] Use Cases

1. **[Use Case]** Inefficient and Poor ATMs

   [Actors] Bank Owner Fells Wargo, ATM machine, Customer, Bank

   [Description] Fells Wargo is the owner of a bank, where his bank often competes with the other local bank, DT Bank. Recently, his clients often complain about his ATM machines, especially when they don't have enough money or they fail to accept bills or checks. Now, Fells is losing clients to DT Bank and other competitors because of clients being unhappy with the service given by Fells' ATM machines across town. Now, Fells must look for a solution that will help bring back his previous clients and bring in new clients to his ATM machines.

   The ATM Management System Database will help Fells bring in clients by maintaining his ATM machines better. This includes maintaining the physical devices associated with the ATM and being able to oversee the various transactions that go about at his bank.

---

2. **[Use Case]** Withdrawing Money from a Checkings Account

   [Actors] User Thomas, ATM Machine, Debit Card, NFC scanner, Keypad, Check

   [Description] Thomas is a hardworking marketing analyst at a big corporation. After being laid-off during the pandemic, Thomas has learned to be better by saving some of the money at his new job. After work, Thomas goes to the local ATM about five minutes from his workplace. Thomas taps/scans his debit card along the NFC reader, and he promptly enters his pin into the keypad. After the ATM machine verifies that it is Thomas, he deposits a check that is worth 20% of his weekly paycheck into his savings account. Promptly after depositing his check, he ends his login

session at the ATM machine to prevent the next person in line from stealing his money. Thomas has become a smarter man by saving his money for the next rainy day, ..or pandemic.

The ATM Management System Database will better help the everyday user with common tasks like depositing checks into their savings account. For Thomas, that means quickly getting what he needs to get done at the ATM after a long week at the office. Most importantly, Thomas can rest well knowing his money is well-managed and secure.

---

3. **[Use Case]** Managing a College Student's Checking Account
   [Actors] User Mia, ATM Machine, Debit Card, Checking Account, Notifications
   [Description] Mia is a college student who is living away from home. She must manage every day finances, including paying for groceries and making sure she pays her monthly rent. The other day, Mia withdrew a sizable amount of money ($1,400) to pay for her monthly apartment rent. A few days later, Mia makes a grocery run at her local Target. She decides to splurge and buy a nice, big piece of steak. She charges her debit card in order to pay for her $76 worth of groceries. After she is done paying, she gets a notification from her bank on her phone stating she overcharged her checking account, going from an original balance of $62 to a -$14. Mia must now pay the $14 owed, as well as the overdraft fee of $30 for each week she fails to pay off her debt and stay above a negative balance. Luckily for Mia, she can pay off her debt and overdraft fee the following day, when she gets her weekly paycheck from working as a tutor.

   The ATM Management System Database will help maintain an efficient manner for banking institutions as well as general users. While Mia

is unhappy with overspending, she is at least grateful to not be blindsided by weekly overdraft fees and can promptly pay off both charges soon.

---

4. **[Use Case]** Attempting to commit fraud
   [Actors] User Rose, User Robert, ATM machine, debit card, NFC card reader, keypad
   [Description] Rose is a regular at her local bank's ATM machine. However, Rose is in a rush today because she has to get to her doctor's appointment on time. As she rushes to her car, she drops her debit card on the floor without her noticing. Eventually, Robert comes along and picks up the card. Instead of giving it to the teller inside the bank, Robert attempts to use the card at the ATM machine. He scans the card along the NFC reader, but struggles to enter the correct pin after several attempts. Following these attempts, the ATM machine locks Robert out for an hour after many failed attempts, and notifies Rose via text message that suspicious activity has taken place at this particular ATM machine.

   The ATM Management System Database ensures a better and safer experience for the average user. Instead of creating an environment where fraud could easily take place, this management system creates a better sense of security and ease for verified users like Rose. This gives Rose the opportunity to take action about her lost debit card.

---

5. **[Use Case]** Making a Loan
   [Actors] User Fiona, the Bank, a Loan
   [Description] Fiona lost her job at the beginning of the pandemic. However, all is not lost. Fiona had money saved up, and began a small business selling her crafts on various marketplaces online. In order to make the next step, she

applies for a loan at her local bank. After a few days, the bank approves the loan and Fiona can get to work on the next chapter of her business. The loan is now tied to her bank account, and she must pay off the loan at an interest rate of 4% over several years. Fiona decides to invest some of the money into marketing and advertisements. A few months later, one of her promotions goes viral and she receives many orders in the following weeks. Fiona will have no problem paying off her loans, especially while her business is booming.

The ATM Management System Database will help users like Fiona transform their lives. Through efficient banking practices and quick loans, Fiona will spend less time worrying about finances and can spend more time doing the things she loves.

---

6. **[Use Case]** Looking for an Affiliate
   [Actors] Bank Owner John, Affiliate Winter
   [Description] John is an owner of a fairly new bank. Unlike his competitor banks, who have been well-established for many years, John has struggled to bring in a large volume of clients on a consistent basis. He seeks an affiliate who is well known in the community. Here's Winter, a trusted person well known in the community and appears in many advertisements. John works out a contract with Winter to be affiliated with his bank. Winter's appearances in new advertisements listing out their affiliate helps bring John more consistent clients to his bank.

   John is brought to tears of joy by the new found flow of clients that his affiliate Winter has brought him. His new affiliate has changed the way his bank operates for the better, and he hopes to bring in more affiliates in the future.

[Section III] Database Requirements (Business Rules)

1. General User
    a. An employee is a verified user
    b. A general user shall be able to create at least one bank account
2. Verified User
    a. A verified user is a general user
    b. A verified user is an employee
    c. A verified user can apply for a loan
    d. A verified user has many verified devices
3. Cash
    a. A cash is had by one verified user
    b. A cash interacts with one cash dispenser
4. Check
    a. A check is had by one verified user
    b. A check interacts with a check deposit slot
5. Bank Account
    a. A bank account is a checkings account
    b. A bank account is a savings account
    c. A bank account belongs to only one general user
    d. A bank account is managed by one bank
    e. A bank account is linked to at least one form of verification method
    f. A bank account has at least one role/permission
6. Bank
    a. A bank manages at least one bank account
    b. A bank owns at least one ATM machine
    c. A bank is owned by at least one owner
    d. A bank has at least one employee

e. A bank authorizes many transactions
f. A bank has many security alarms
g. A bank offers many loans

7. ATM Machine
    a. An ATM machine is owned by one bank
    b. An ATM machine has login sessions
    c. An ATM machine conducts transactions
    d. An ATM machine is managed by many admins
    e. An ATM machine has at least one language
8. Checking Account
    a. A checkings account is a bank account
9. Savings Account
    a. A savings account is a bank account
10. Verification Method
    a. A verification method is tied to only one bank account
    b. A verification method is a card
    c. A verification method is a digital wallet
11. Card
    a. A card is linked to many digital wallets
12. Debit Card
    a. A debit card is a card
13. Credit Card
    a. A credit card is a card
14. Digital Wallet
    a. A digital wallet is linked to at least one card
15. Transactions
    a. A transaction is conducted by an ATM machine

b. A transaction is authorized by a bank

16. Cash Withdrawal
    a. A cash withdrawal is a transaction
    b. A cash withdrawal is processed/fulfilled by one deposit cash slot
17. Cash Deposit
    a. A cash deposit is a transaction
    b. A cash withdrawal is processed/fulfilled by one deposit cash slot
18. Check Deposit
    a. A check deposit is a transaction
    b. A check withdrawal is processed/fulfilled by deposit check slot
19. Payment
    a. A payment is a transaction
    b. A payment can be made to pay off many loans
20. Transfer
    a. A transfer is a transaction
21. Notifications
    a. A notification is received by many verified devices
    b. A notification is prompted by one security alarm
22. Logins
    a. A login session is linked to only one verified user
    b. A login session supports one device
23. Verified Device
    a. A verified device receives many notifications
    b. A verified device is owned by only one verified user
24. Languages
    a. A language is supported by many ATM machines
25. Devices

a. A device is had in an ATM machine

26. NFC Scanner
    a. An NFC scanner is a device
    b. An NFC scanner interacts with one verified user per login
    c. An NFC scanner scans one verification method per login
27. Card Reader
    a. A card reader is an device
    b. A card reader scans with one card per login
28. Keypad
    a. A keypad is an device
    b. A keypad interacts with one verified user per login
    c. A keypad triggers many security alarms
29. OLED Screen
    a. An OLED screen is an device
    b. An OLED screen interacts with one verified user per login
30. Cash Dispenser
    a. A cash dispenser is an device
    b. A cash dispenser processes many cash deposits per login
    c. A cash dispenser processes many cash withdrawals per login
31. Check Deposit Slot
    a. A check deposit slot is an device
    b. A check deposit slot processes many check deposits per login
32. Receipt Printer
    a. A receipt printer is an device
    b. A receipt printer prints out a transaction
33. Speaker
    a. A receipt printer is an device

34. Manufacturer
    a. A manufacturer manufactures at least one device
    b. A manufacturer manufacturers at least one security alarm
35. Owner
    a. An owner owns at least one bank.
36. Affiliates
    a. An affiliate is affiliated with many banks
37. Security Alarm
    a. A security alarm is installed in many banks
    b. A security alarm is triggered by many keypads
    c. A security alarm informs many security guards
    d. A security alarm is manufactured by one manufacturer
    e. A security alarm prompts many notifications
38. Employees
    a. An employee works for one bank
    b. An employee is a verified user
    c. An employee can be an admin, which is also an employee
39. Admin
    a. An admin is also an employee
    b. An admin manages at least one ATM machine
    c. An admin maintains at least one device
    d. An admin handles a least one role/permission
40. Roles/Permissions
    a. A role/permission is handled by at least one admin
    b. A role/permission is had by many bank accounts
41. Security
    a. A security guard is an employee

b. A security guard is informed by at many security alarms

42. Analyst
    a. An analyst is an employee
43. Teller
    a. A teller is an employee
44. Consultant
    a. A consultant is an employee
45. Loans
    a. A loan is offered by many banks
    b. A loan is linked to one bank account
    c. A loan can be paid off by many payments

[Section IV] Detailed List of Main Entities, Attributes, and Keys

1. General User (Strong)
    a. user_id: key, numeric
    b. name: composite, alphanumeric
    c. first_name: alphanumeric
    d. last_name: alphanumeric
    e. email: alphanumeric
    f. ssn: numeric
    g. address: multivalue, alphanumeric
    h. phone_number: alphanumeric
2. Verified User (Weak)
    a. verified_user_id: key, numeric
    b. user_id: key, numeric
    c. privileges: numeric
3. Currency (Strong)
    a. currency_id: key, numeric
    b. currency_type: alphanumeric
    c. amount: alphanumeric
4. Check (Strong)
    a. check_id: key, numeric
    b. verified_user_id: key, numeric
    c. check_amount: alphanumeric
5. Bank Account (Weak)
    a. bank_account_id: key, numeric
    b. bank_id: key, numeric
    c. account_number: numeric
6. Bank (Strong)

    a. bank_id: key, numeric
    b. name: composite, alphanumeric
    c. address: composite, alphanumeric
7. ATM Machine (Strong)
    a. Atm_machine_id: key, numeric
    b. status: alphanumeric
    c. Bank_id: key, numeric
8. Checking Account (Weak)
    a. checking_account_id: key, numeric
    b. balance: numeric
    c. fees: numeric
9. Savings Account (Weak)
    a. savings_account_id: key, numeric
    b. balance: numeric
    c. interest_rate: numeric
10. Verification Method (Weak)
    a. verification_id: key, numeric
    b. verified_user_id: key, numeric
    c. verification_type: alphanumeric
11. Card (Strong)
    a. card_id: key, numeric
    b. type: alphanumeric
    c. CVV: numeric
    d. zip: alphanumeric
    e. exp_date: multivalue, timestamp
12. Debit Card (Weak)
    a. debit_card_number: key, numeric

b. CVV: numeric
c. zip: alphanumeric
d. exp_date: multivalue, timestamp

13. Credit Card (Weak)
    a. Credit_card_number: key, numeric
    b. CVV: numeric
    c. zip: alphanumeric
    d. exp_date: multivalue, timestamp
14. Digital Wallet (Strong)
    a. wallet_id: key, numeric
    b. card_number: key, numeric
    c. type: alphanumeric
15. Transactions (Strong)
    a. transaction_id: key, numeric
    b. type: alphanumeric
    c. amount: numeric
16. Cash Withdrawal (Weak)
    a. cash_withdrawal_id: key, numeric
    b. transaction_id: key, numeric
    c. balance: numeric
17. Cash Deposit (Weak)
    a. cash_deposit_id: key, numeric
    b. transaction_id: key, numeric
    c. balance: numeric
18. Check Deposit (Weak)
    a. check_deposit_id: key, numeric
    b. transaction_id: key, numeric

    c. balance: numeric

19. Payment (Weak)
    a. payment_id: key, numeric
    b. transaction_id: key, numeric
    c. balance: numeric
20. Transfer (Weak)
    a. transfer_id: key, numeric
    b. transaction_id: key, numeric
    c. balance: numeric
21. Notifications (Strong)
    a. notification_id: key, numeric
    b. message: alphanumeric
    c. timestamp: multivalue, timestamp
22. Logins (Weak)
    a. logins_id: key, numeric
    b. verified_user_id: key, numeric
    c. data: alphanumeric
    d. expiration: composite, alphanumeric
23. Verified Devices (Weak)
    a. verified_device_id: key, numeric
    b. verified_user_id: key, numeric
    c. device_type: alphanumeric
24. Languages (Strong)
    a. language_id: key, numeric
    b. language_name: alphanumeric
    c. country: alphanumeric
25. Devices (Strong)

a. device_id: key, numeric
b. manufacturer_id: key, numeric
c. type: alphanumeric
d. status: alphanumeric

26. NFC Scanner (Weak)
    a. scanner_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
27. Card Reader (Weak)
    a. reader_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
28. Keypad (Weak)
    a. reader_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
29. OLED Screen (Weak)
    a. screen_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
30. Cash Dispenser (Weak)
    a. cash_dispenser_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
31. Deposit Check Slot (Weak)
    a. check_slot_id: key, numeric
    b. manufacturer_id: key, numeric

c. status: alphanumeric

32. Receipt Printer (Weak)
    a. receipt_printer_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
33. Speaker (Weak)
    a. speaker_id: key, numeric
    b. manufacturer_id: key, numeric
    c. status: alphanumeric
34. Manufacturer (Strong)
    a. manufacturer_id: key, numeric
    b. name: composite, alphanumeric
    c. address: multivalue, alphanumeric
35. Owner (Strong)
    a. owner_id: key, numeric
    b. name: composite, alphanumeric
    c. first_name: alphanumeric
    d. last_name: alphanumeric
36. Affiliates (Strong)
    a. affiliate_id: key, numeric
    b. name: composite, alphanumeric
    c. Contract: alphanumeric
37. Security Alarm (Strong)
    a. alarm_id: key, numeric
    b. manufacturer_id: key, numeric
    c. range: composite, numeric
38. Employees (Strong)

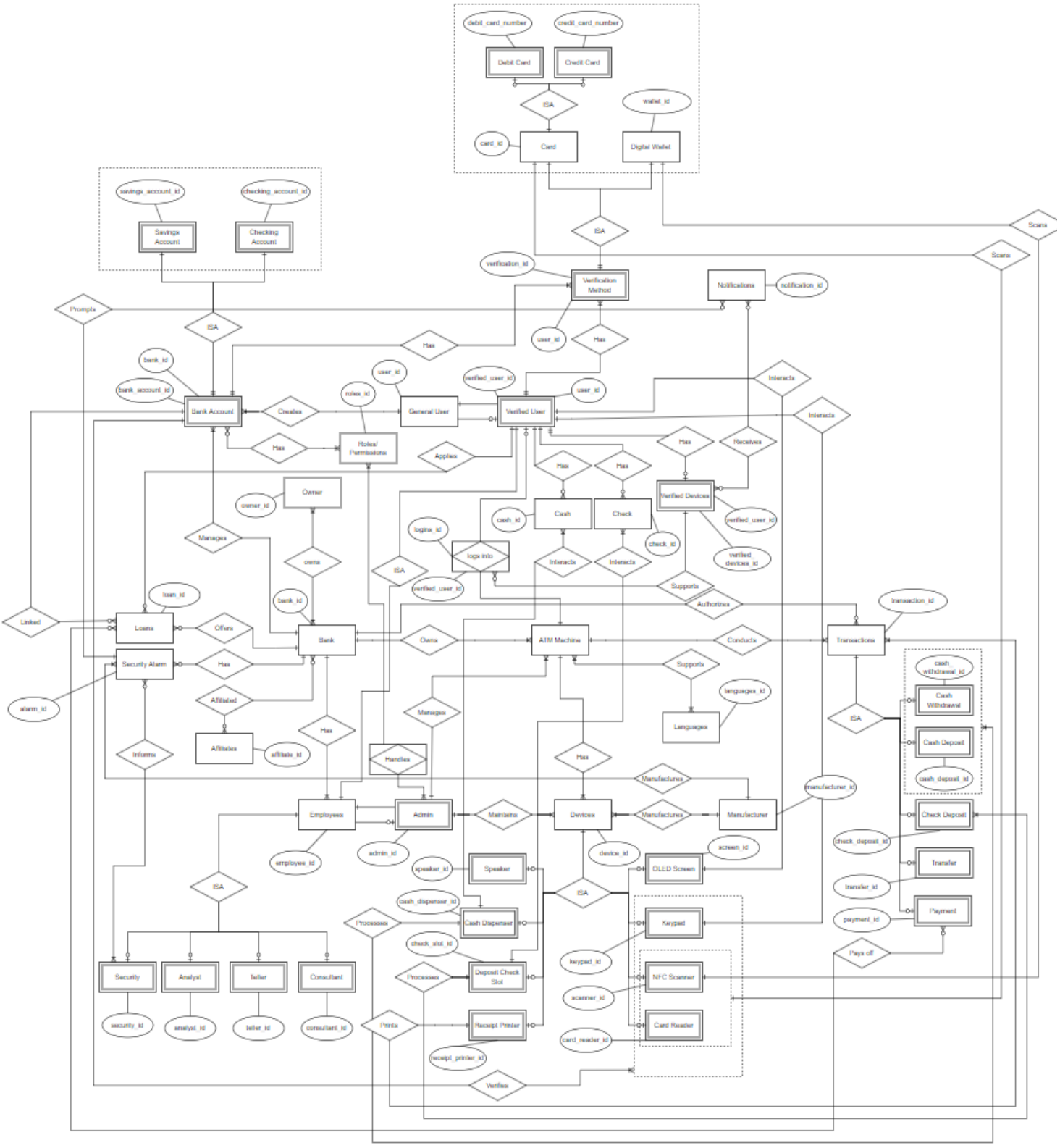
a. Employee_id: key, numeric
b. name: composite, alphanumeric
c. first_name: alphanumeric
d. last_name: alphanumeric
e. email: alphanumeric

39. Admin (Weak)
    a. admin_id: key, numeric
    b. employee_id: key, numeric
    c. privileges: numeric
40. Roles/Permissions (Strong)
    a. roles_id: key, numeric
    b. admin_id: key, numeric
    c. roles_type: multivalue, alphanumeric
41. Security (Weak)
    a. security_id: key, numeric
    b. employee_id: key, numeric
    c. privileges: numeric
42. Analyst (Weak)
    a. analyst_id: key, numeric
    b. employee_id: key, numeric
    c. privileges: numeric
43. Teller (Weak)
    a. teller_id: key, numeric
    b. employee_id: key, numeric
    c. privileges: numeric
44. Consultant (Weak)
    a. teller_id: key, numeric

b. employee_id: key, numeric
c. privileges: numeric

45. Loans (Strong)
    a. loan_id: key, numeric
    b. loan_rate: numeric
    c. loan_type: alphanumeric
    d. loan_interest_rate: numeric

[Section V] Entity Relationship Diagram (ERD)



[Section VI] Testing Table

Rule	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Error Description
1	Bank	Manages	Bank Accounts	One to Many	Pass	None
2	Bank Account	Manages	Bank	Many to One	Pass	None
3	Bank	Manages	ATM Machine	One to Many	Fail	An entire bank managing ATMs is too broad. An entire bank won't manage each ATM machine, but a few individuals instead. Changed relation to "Owns"
4	General User	Uses	ATM Machine	One to Many	Fail	A general user must have a bank account as well as the proper credentials in order to use an ATM machine first.
5	General User	Creates	Bank Account	Many to Many	Fail	I considered the possibility of a joint account, but it falls under the possibilities of the same issues (and lack of future flexibility) of an Employees table based on teams. Changed to One to

						Many
6	General User	Creates	Bank Account	One to Many	Pass	None
7	Bank	Owns	Owner	Many to One	Fail	A bank may have multiple owners
8	Bank	Has	Employee	One to Many	Pass	None
9	Bank Account	Has	Savings Account	One to One	Fail	A savings account is a bank account. Change applied to checking account as well
10	Bank Account	ISA	Checking Account	One to One	Pass	None
11	Security	ISA	Employee	One to One	Pass	None
12	Analyst	ISA	Employee	One to One	Pass	None
13	Teller	ISA	Employee	One to One	Pass	None
14	Consultant	ISA	Employee	One to One	Pass	None
15	ATM Machine	Has	Devices	One to Many	Pass	None
16	ATM	Supports	Languages	Zero To	Fail	A functional ATM

	Machine			Many		Machine should have at least 1 language supported in order to function
17	ATM Machine	Has	Devices	One to Many	Pass	None
18	Admin	Monitors	ATM Machine	One to Many	Fail	The relation monitor is a little narrow. Changed to manages
19	Admin	Maintains	Devices	One to Many	Pass	None
20	Manufacturer	Manufactures	Devices	One to One	Fail	A manufacturer can produce more than one device
21	Device	Manufactures	Manufacturer	Many to One	Pass	None
22	NFC Scanner	ISA	Device	One to One	Pass	None
23	Card Reader	ISA	Device	One to One	Pass	None
24	Keypad	ISA	Device	One to One	Pass	None
25	OLED screen	ISA	Device	One to One	Pass	None
26	Cash Dispenser	ISA	Device	One to One	Pass	None

27	Deposit Check Slot	ISA	Device	One to One	Pass	None
28	Receipt Printer	ISA	Device	One to One	Pass	None
29	Speaker	ISA	Device	One to One	Pass	None
30	Verified User	Has	Cash	One To Many	Pass	None
31	General User	ISA	Verified User	One to One (recursive)	Pass	None
32	Admin	ISA	Employee	One to One (recursive)	Pass	None
33	Verified User	Has	Verification Method	One to One	Fail	A verified user can have more than one verification method, like a debit card or a digital wallet
34	Credit Card	ISA	Card	One to One	Pass	None
35	Debit Card	ISA	Card	One to One	Pass	None
36	Card	Linked	Digital	One to	Fail	A card can be linked to

			Wallet	One		many digital wallets. Changed to One to Many
37	Card	ISA	Verification Method	One to One	Pass	None
38	Digital Wallet	ISA	Verification Method	One to One	Pass	None
39	Employee	ISA	Verified User	One to One	Pass	None
40	Verified User	Logs into	ATM Machine	One to One	Pass	None
41	Bank Account	Has	Verification Method	One to One	Fail	A bank account should already have 1 form of verification (debit card), but may have more, including a credit card and/or a digital wallet. Changed to One to Many
42	Verified User	Has	Verified Devices	One to One	Fail	A typical user would probably have more than one device. Changed to One to Many
43	Verified Devices	Views	Transactions	One to Many	Fail	Initially wanted some form of online banking to see transactions, but current implementation would not support this

						well
44	ATM Machine	Conducts	Transactions	One to Many	Pass	None
45	Bank Account	Links	ATM Machine	One to One	Fail	This is redundant since a verified user can log in with their verification method, which is already linked to a bank account
46	Verified Devices	Receive	Notifications	Many to Many	Pass	None
47	Bank	Authorizes	Transactions	One to Many	Pass	None
48	Cash Withdrawal	ISA	Transactions	One to One	Pass	None
49	Cash Deposit	ISA	Transactions	One to One	Pass	None
50	Check Deposit	ISA	Transactions	One to One	Pass	None
51	Payment	ISA	Transactions	One to One	Pass	None
52	Transfer	ISA	Transactions	One to One	Pass	None
53	Verified User	Scans	NFC Scanner/Card Reader	One to One (aggregati	Fail	Verified User doesn’t directly scan the device

				on)		
54	Verification Method	Scans	NFC Scanner/Card Reader	One to One (aggregation)	Fail	Digital Wallet can't be read on a card reader
55	Card	Scans	NFC Scanner/Card Reader	One to One (aggregation)	Passes	None
56	Digital Wallet	Scans	NFC Scanner	One to One	Passes	None
57	NFC Scanner/Card Reader	Verifies	Bank Account	One to One	Fails	A keypad must be included for entering a pin
58	Verified User	Interacts	Keypad	One to One	Pass	None
59	Verified User	Interacts	OLED Screen	One to One	Pass	None
60	Verified User	Interacts With	Cash Dispenser	One to One	Fail	A verified user doesn't directly interact with the cash dispenser.
61	Verified User	Interacts With	Check Deposit Slot	One to One	Fail	A verified user doesn't directly interact with the check deposit slot either.
62	Receipt	Prints	Transaction	One to	Fail	A receipt printer should be

	Printer			One		able to print out many transactions
63	Cash Dispenser	Processes	Cash Withdrawal /Cash Deposit	One to Many (aggregation)	Pass	None
64	Deposit Check Slot	Processes	Deposit Check	One to Many	Pass	None
65	Bank	Has	Security Alarm	One to Many	Pass	None
66	Security Alarm	Informs	Security	One to Many	Fails	There may be multiple alarms in the bank that inform security guards
67	Bank	Affiliated with	Affiliate	One to Many	Fails	An affiliate might be sponsored with more than one bank
68	Bank	Offers	Loans	Many to Many	Pass	In this context, a bank should offer many loans.
69	Bank	Offers	Loans	One to Many	Pass	None
70	Manufacturer	Manufactures	Security Alarm	One to Many	Pass	None
71	Payment	Pays Off	Loan	One to One	Fail	A loan may take several payments to pay off. A user may also have several

						loans to pay off
72	Loan	Linked	Bank Account	One to One	Fail	A bank account might be linked to many loans
73	Verified User	Applies	Loan	One to Many	Pass	None
74	Admin	Handles	Roles/Permissions	Many to Many	Pass	None
75	Roles/Permissions	Has	Bank Accounts	Many to Many	Pass	None
76	Security Alarm	Prompts	Notification	Many to Many	Fail	Many alarms prompting a notification would be inefficient, as well as annoying to the user.
77	User	Has	Check	One to Many	Pass	None
78	Cash	Interacts	Cash Dispenser	One to One	Fail	Many cash can be inserted into/taken out of a cash dispenser
79	Check	Interacts	Deposit Check Slot	Many to One	Pass	None

[Section VII] Database Model / EER

1. See attached eer.mwb file in Files folder of M2 repo

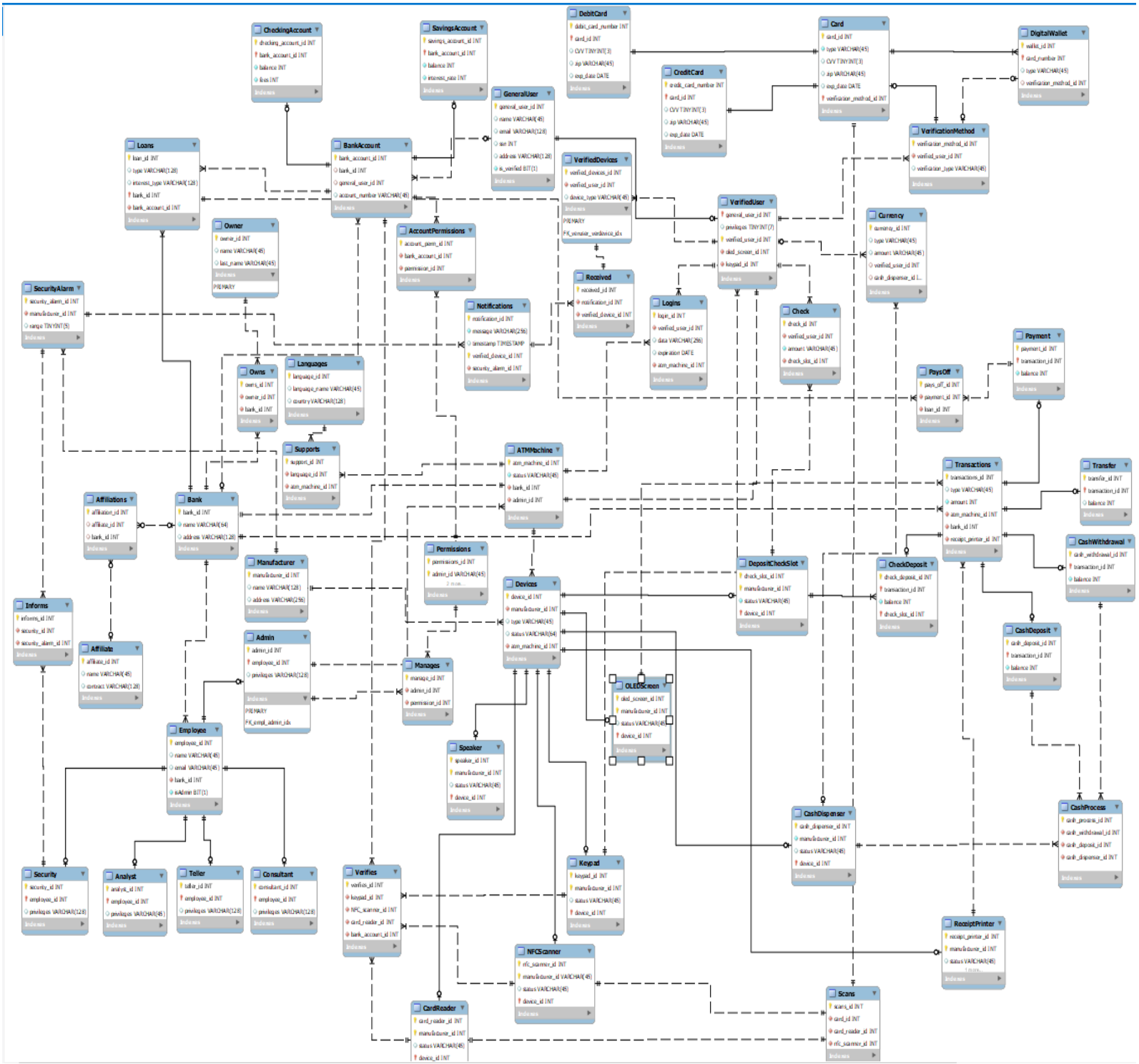


Table	FK	ON DELETE	ON UPDATE	Comment
VerifiedUser	general_user_id	ON CASCADE	ON CASCADE	When a general user is deleted, there will be no associated verified user to the general user
BankAccount	general_user_id	SET NULL	ON CASCADE	If a general user is deleted, the associated bank account will be set to null
BankAccount	bank_id	SET NULL	ON CASCADE	If a bank is deleted, the bank account will be set to null
CheckingAccount	bank_account_id	ON CASCADE	ON CASCADE	When a bank account is deleted, so does the checking account associated with it
SavingsAccount	bank_account_id	ON CASCADE	ON CASCADE	When a bank account is deleted, so does the savings account associated with it
Owns	bank_id	ON CASCADE	ON CASCADE	When a bank is deleted, delete the ownership associated with it
Owns	owner_id	ON CASCADE	ON CASCADE	When an owner is deleted, delete any ownership associated with it
VerificationMethod	verified_user_id	ON CASCADE	ON CASCADE	When a verified user gets deleted, so does their verified devices
Card	verification_method_id	ON CASCADE	ON CASCADE	When a verification method gets deleted, the card is deemed as invalid
DebitCard	card_id	ON CASCADE	ON CASCADE	When a card gets deleted, the debit card is invalid
CreditCard	card_id	ON CASCADE	ON CASCADE	When a card gets deleted, the credit card is invalid
DigitalWallet	card_id	ON CASCADE	ON CASCADE	When a card gets deleted, set the digital wallet to null until a new card is linked to the wallet

DigitalWallet	verification_method_id	ON CASCADE	ON CASCADE	When a verification method gets deleted, the digital wallet is deemed as invalid
ATMMachine	bank_id	ON CASCADE	ON CASCADE	When a bank is deleted, the corresponding ATM must be deleted too
Logins	verified_user_id	ON CASCADE	ON CASCADE	When a verified user is deleted, then the login session should be deleted too
Logins	atm_machine_id	ON CASCADE	ON CASCADE	When an ATM machine is deleted, the sessions associated with the machine must be deleted
VerifiedDevices	verified_user_id	ON CASCADE	ON CASCADE	When verified user is deleted, so does the verified devices associated with it
Received	verified_device	ON CASCADE	ON CASCADE	When a verified device is deleted, the notifications received are deleted
Received	notification_id	ON CASCADE	ON CASCADE	When a notification is deleted so does the notification received
Employee	bank_id	ON CASCADE	ON CASCADE	When a bank gets deleted, the employees are left jobless (and therefore not employees anymore)
Admin	employee_id	ON CASCADE	ON CASCADE	When an employee is deleted, they are no longer an admin either
AccountPermissions	permissions_id	ON CASCADE	ON CASCADE	When a permission is deleted, the account will no longer support that permission
AccountPermissions	bank_account_id	ON CASCADE	ON CASCADE	When a bank account is deleted, it no longer requires any permissions
Manages	admin_id	ON	ON	When an admin is deleted,

		CASCADE	CASCADE	they no longer manage any permissions
Manages	permission_id	ON CASCADE	ON CASCADE	When a permission is deleted, that permission will no longer need to be managed
ATM Machine	admin_id	NO ACTION	ON CASCADE	An ATM Machine will continue to exist and perform transactions if an ATM admin is deleted
Affiliations	affiliate_id	ON CASCADE	ON CASCADE	When a affiliate is deleted, they no longer have an affiliation
Affiliations	bank_id	ON CASCADE	ON CASCADE	When a bank is deleted, there is no longer an affiliation
Loans	bank_id	ON CASCADE	ON CASCADE	When a bank is deleted, the loan is no longer offered by the associated bank
Loans	bank_account_id	ON CASCADE	ON CASCADE	When a bank account is deleted, the loan is no longer tied to the bank account
Security	employee_id	ON CASCADE	ON CASCADE	When an employee is deleted, they can no longer be a security guard either
Consultant	employee_id	ON CASCADE	ON CASCADE	When an employee is deleted, they can no longer be a consultant either
Analyst	employee_id	ON CASCADE	ON CASCADE	When an employee is deleted, they can no longer be a analyst either
Teller	employee_id	ON CASCADE	ON CASCADE	When an employee is deleted, they can no longer be a teller either
Notifications	security_alarm_id	ON CASCADE	ON CASCADE	When a security alarm is deleted, the notifications associated with that alarm

				are deleted as well
Informs	security_id	ON CASCADE	ON CASCADE	When a security is deleted, there is no one to inform
Informs	security_alarm_id	ON CASCADE	ON CASCADE	When an alarm is deleted, there is nothing to inform with
Devices	atm_machine_id	ON CASCADE	ON CASCADE	When an ATM machine is deleted, this device should be rendered useless
Devices	manufacturer_id	NO ACTION	ON CASCADE	When a manufacturer gets deleted, the device manufactured by them still continues to exist
SecurityAlarm	manufacturer_id	NO ACTION	ON CASCADE	When a manufacturer gets deleted, the security alarm manufactured by them still continues to exist
Speaker	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the speaker must be deleted too
CashDispenser	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the cash dispenser must be deleted too
DepositCheckSlot	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the check slot must be deleted too
ReceiptPrinter	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the receipt printer must be deleted too
OLEDScreen	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the OLED screen must be deleted too
Keypad	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the keypad must be deleted too
NFCScanner	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the NFC scanner must be deleted too

CardReader	device_id	ON CASCADE	ON CASCADE	When a device is deleted, the card reader must be deleted too
Supports	atm_machine_id	ON CASCADE	ON CASCADE	When an ATM is deleted, it no longer supports a language
Supports	language_id	ON CASCADE	ON CASCADE	When a language is deleted, it is no longer supported
Transaction	atm_machine_id	ON CASCADE	ON CASCADE	When an ATM is deleted, so do its corresponding transactions
CashDeposit	transaction_id	ON CASCADE	ON CASCADE	When a transaction is deleted, the corresponding cash deposit must be deleted too
CashWithdrawal	transaction_id	ON CASCADE	ON CASCADE	When a transaction is deleted, the corresponding cash withdrawal must be deleted too
CheckDeposit	transaction_id	ON CASCADE	ON CASCADE	When a transaction is deleted, the corresponding check deposit must be deleted too
Transfer	transaction_id	ON CASCADE	ON CASCADE	When a transaction is deleted, the corresponding transfer must be deleted too
Payment	transaction_id	ON CASCADE	ON CASCADE	When a transaction is deleted, the corresponding payment must be deleted too
PaysOff	loan_id	ON CASCADE	ON CASCADE	When a loan is deleted, there is nothing to pay off
PaysOff	payment_id	NO ACTION	ON CASCADE	When a payment is deleted, there may still be something that needs to be paid off
CheckDeposit	check_slot_id	NO ACTION	ON CASCADE	When a check slot is deleted, the check deposit transaction should still remain

Currency	verified_user_id	SET NULL	ON CASCADE	When a verified user is deleted, the currency will be set to null until a new user is assigned
Currency	cash_dispenser_id	SET NULL	ON CASCADE	When a cash_dispenser is deleted, the currency will be set to null until a new cash dispenser is assigned
Check	verified_user_id	ON CASCADE	ON CASCADE	When a verified user is deleted, the checks associated with that user are deemed unusable
Check	check_slot_id	NO ACTION	ON CASCADE	When a check slot is deleted, a check cannot interact with that check slot anymore
Transaction	bank_id	ON CASCADE	ON CASCADE	When a bank is deleted, all associated transactions are deleted as well
Verifies	keypad_id	ON CASCADE	ON CASCADE	When a keypad is deleted, the bank account cannot be verified
Verifies	NFC_scanner_id	ON CASCADE	ON CASCADE	When a NFC scanner is deleted, the bank account cannot be verified
Verifies	card_reader_id	ON CASCADE	ON CASCADE	When a card reader is deleted, the bank account cannot be verified
Verifies	bank_account_id	ON CASCADE	ON CASCADE	When a bank account is deleted, it can no longer be verified
Scans	card_id	ON CASCADE	ON CASCADE	When a card is deleted, there is nothing to scan
Scans	nfc_scanner_id	ON CASCADE	ON CASCADE	When a NFC scanner is deleted, a card cannot be verified
Scans	card_reader_id	ON CASCADE	ON CASCADE	When a card reader is deleted, a card cannot be

				verified
Transaction	receipt_printer_id	ON CASCADE	ON CASCADE	When a receipt printer gets deleted, the transaction cannot be processed on paper
VerifiedUser	oled_screen_id	ON CASCADE	ON CASCADE	When an OLED screen is deleted, the user cannot interact with it
CashProcess	cash_withdrawal_id	ON CASCADE	ON CASCADE	When a transaction is deleted there is nothing to process
CashProcess	cash_deposit_id	ON CASCADE	ON CASCADE	When a transaction is deleted there is nothing to process
CashProcess	cash_dispenser_id	ON CASCADE	ON CASCADE	When a cash dispenser is deleted there is nothing to process the transaction

[Section VIII] Forward Engineering

1. See attached databasemodel.sql and triggers.sql file in Files folder of M2 repo

[Section IX] Inserting Data

1. See attached inserts.sql in Files folder of M2 repo

[Section X] Testing

1. See attached test.sql in Files folder of M2 repo

[Section XI] Testing Table

Entity	SQLQuery	Pass/Fail	Error Description	Possible Solution
Bank	Delete	Fail	A foreign key constraint fails	Adjust ON DELETE for FK with AccountPermissions
Bank	Update	Pass	None	None
General User	Delete	Pass	None	None
General User	Update	Pass	None	None
BankAccount	Delete	Pass	None	None
BankAccount	Update	Pass	None	None
CheckingAccount	Delete	Pass	None	None
CheckingAccount	Update	Pass	None	None
SavingsAccount	Delete	Pass	None	None
SavingsAccount	Update	Pass	None	None
Owner	Delete	Fail	A foreign key constraint fails	Adjust ON DELETE for FK with Owns
Owner	Update	Pass	None	None
Owns	Delete	Pass	None	None
Owns	Update	Pass	None	None
Affiliate	Delete	Pass	None	None
Affiliate	Update	Pass	None	None
Affiliations	Delete	Pass	None	None
Affiliations	Update	Pass	None	None
Employee	Delete	Pass	None	None

Employee	Update	Pass	None	None
Admin	Delete	Fail	A foreign key constraint fails	Adjust ON DELETE for FK with ATMMachine
Admin	Update	Pass	None	None
Security	Delete	Pass	None	None
Security	Update	Pass	None	None
Analyst	Delete	Pass	None	None
Analyst	Update	Pass	None	None
Consultant	Delete	Pass	None	None
Consultant	Update	Pass	None	None
Teller	Delete	Pass	None	None
Teller	Update	Pass	None	None
Permissions	Delete	Pass	None	None
Permissions	Update	Pass	None	None
Manages	Delete	Pass	None	None
Manages	Update	Pass	None	None
AccountPermissions	Delete	Pass	None	None
AccountPermissions	Update	Pass	None	None
Manufacturer	Delete	Pass	None	None
Manufacturer	Update	Pass	None	None
SecurityAlarm	Delete	Pass	None	None
Security Alarm	Update	Fails	A foreign key constraint fails	Adjust ON UPDATEfor FK with Manufacturer
Informs	Delete	Pass	None	None

Informs	Update	Pass	None	None
ATMMachine	Delete	Pass	None	None
ATMMachine	Update	Pass	None	None
Languages	Delete	Pass	None	None
Languages	Update	Pass	None	None
Supports	Delete	Pass	None	None
Supports	Update	Pass	None	None
Loans	Delete	Fail	A foreign key constraint fails	Adjust ON DELETE for FK with paysOff
Loans	Update	Pass	None	None
Device	Delete	Pass	None	None
Device	Update	Pass	None	None
Speaker	Update	Pass	None	None
Speaker	Delete	Pass	None	None
CardReader	Delete	Pass	None	None
CardReader	Update	Pass	None	None
NFCScanner	Delete	Pass	None	None
NFCScanner	Update	Pass	None	None
Keypad	Delete	Pass	None	None
Keypad	Update	Pass	None	None
OLEDScreen	Delete	Pass	None	None
OLEDScreen	Update	Pass	None	None
DepositCheckSlot	Delete	Pass	None	None
DepositCheckSlot	Update	Pass	None	None

CashDispenser	Delete	Pass	None	None
CashDispenser	Update	Pass	None	None
ReceiptPrinter	Delete	Pass	None	None
ReceiptPrinter	Update	Pass	None	None
VerifiedUser	Delete	Pass	None	None
VerifiedUser	Update	Pass	None	None
VerifiedDevices	Update	Pass	None	None
VerifiedDevices	Delete	Pass	None	None
Notifications	Update	Pass	None	None
Notifications	Delete	Pass	None	None
Received	Delete	Pass	None	None
Received	Update	Pass	None	None
Logins	Update	Pass	None	None
Logins	Delete	Pass	None	None
Verifies	Delete	Pass	None	None
Verifies	Update	Pass	None	None
VerificationMethod	Update	Pass	None	None
VerificationMethod	Delete	Pass	None	None
Card	Delete	Pass	None	None
Card	Update	Pass	None	None

DebitCard	Delete	Pass	None	None
DebitCard	Update	Pass	None	None
CreditCard	Delete	Pass	None	None
CreditCard	Update	Pass	None	None
DigitalWallet	Delete	Pass	None	None
DigitalWallet	Update	Pass	None	None
Scans	Delete	Pass	None	None
Scans	Update	Pass	None	None
Checks	Delete	Pass	None	None
Checks	Update	Pass	None	None
Currency	Delete	Pass	None	None
Currency	Update	Pass	None	None
Transactions	Update	Pass	None	None
Transactions	Delete	Pass	None	None
Payment	Update	Pass	None	None
Payment	Delete	Fail	A foreign key constraint fails	Adjust ON UPDATEfor FK with paysOff
PaysOff	Delete	Pass	None	None
PaysOff	Update	Pass	None	None
Transfer	Delete	Pass	None	None
Transfer	Update	Pass	None	None
CashWithdrawal	Update	Pass	None	None
CashWithdrawal	Delete	Pass	None	None
CashDeposit	Update	Pass	None	None
CashDeposit	Delete	Pass	None	None

CashProcess	Update	Pass	None	None
CashProcess	Delete	Pass	None	None