Requirements for Example ATM System

The software to be designed will control a simulated automated teller machine (ATM) having a magnetic stripe reader for reading an ATM card, a keyboard and display for interaction with the customer, a slot for depositing envelopes, a dispenser for cash (in multiples of $20), a printer for printing customer receipts, and a key-operated switch to allow an operator to start or stop the machine. The ATM will communicate with the bank's computer over an appropriate communication link. (The software on the latter is not part of the requirements for this problem.)

The ATM will service one customer at a time. A customer will be required to insert an ATM card and enter a personal identification number (PIN) - both of which will be sent to the bank for validation as part of each transaction. The customer will then be able to perform one or more transactions. The card will be retained in the machine until the customer indicates that he/she desires no further transactions, at which point it will be returned - except as noted below.

The ATM must be able to provide the following services to the customer:

- A customer must be able to make a cash withdrawal from any suitable account linked to the card, in multiples of $20.00. Approval must be obtained from the bank before cash is dispensed.
- A customer must be able to make a deposit to any account linked to the card, consisting of cash and/or checks in an envelope. The customer will enter the amount of the deposit into the ATM, subject to manual verification when the envelope is removed from the machine by an operator. Approval must be obtained from the bank before physically accepting the envelope.
- A customer must be able to make a transfer of money between any two accounts linked to the card.
- A customer must be able to make a balance inquiry of any account linked to the card.

The ATM will communicate each transaction to the bank and obtain verification that it was allowed by the bank. In the case of a cash withdrawal or deposit, a second message will be sent after the transaction has been physically completed (cash dispensed or envelope accepted).

If the bank determines that the customer's PIN is invalid, the customer will be required to re-enter the PIN before a transaction can proceed. If the customer is unable to successfully enter the PIN after three tries, the card will be permanently retained by the machine, and the customer will have to contact the bank to get it back.

If a transaction fails for any reason other than an invalid PIN, the ATM will display an explanation of the problem, and will then ask the customer whether he/she wants to do another transaction.

The ATM will provide the customer with a printed receipt for each successful transaction, showing the date, time, machine location, type of transaction, account(s), amount, and ending and available balance(s) of the affected account ("to" account for transfers).

The ATM will have an operator panel with a key-operated switch (located on the "inside the bank" side) that will allow an operator to start and stop the servicing of customers. When the switch is moved to the

"off" position, the machine will shut down, so that the operator may remove deposit envelopes and reload the machine with cash, blank receipts, etc. The operator will be required to verify and enter the total cash on hand before starting the system from this panel.

ATM Problem Domain Objects

The following objects might be identified by performing domain analysis on the general domain to which our problem belongs:

Tangible Entities

- The ATM machine itself - containing the following
    - Display
    - Card reader
    - Keyboard
    - Cash dispenser
    - Envelope acceptor
    - Receipt printer
    - Operator panel
- Customer
- ATM Card
- Operator
- Bank

Intangible Entities

- Bank account

Events

- Transaction - with the following specializations
    - Cash withdrawl
    - Deposit
    - Transfer between accounts
    - Balance inquiry

Interactions

- System startup by operator
- Customer usage session
- Each kind of transaction listed above will involve some user interaction.
- Repeat entry of an invalid PIN

System Startup Use Case

The system is started up when the operator turns the switch on the operator panel to the "on" position. The operator will be asked to enter the amount of money currently in the cash dispenser. Then servicing of customers can begin - ending later when the operator turns the switch back to the "off" position.

Session Use Case

A session is started when a customer inserts an ATM card into the card reader slot of the machine, which reads the card as it is inserted. (If the reader cannot read the card due to improper insertion or a damaged stripe, the card is ejected, an error screen is displayed, and no session is started.) The customer is asked to enter his/her PIN, and is allowed to perform one or more transactions, choosing the transaction type each time from a menu of options. The session will initiate the appropriate transaction use case, and will furnish the customer's card number and PIN to the transaction. After each successful transaction, the customer is asked whether he/she would like to perform another; after a transaction that fails for any reason other than repeated entries of an invalid PIN, the Failed Transaction Extension is executed. When the customer is through performing transactions, the card is ejected from the machine and the session ends.

Cash Withdrawl Transaction Use Case

A cash withdrawal transaction is started from within a session when the customer chooses cash withdrawal from the menu of possible transaction types. The customer chooses a type of account to withdraw from (e.g. checking) from a menu of possible accounts, and then chooses a dollar amount from a menu of possible amounts. The system verifies that it has sufficient money on hand to satisfy the request. If not, it reports a failure to the session, which initiates the Failed Transaction Extension to report the problem. If there is sufficient cash, it sends the customer's card number, PIN, chosen account and amount to the bank, which either approves or disapproves the transaction. If the transaction is approved, the machine dispenses the correct amount of cash and issues a receipt. If the transaction is disapproved due to an incorrect PIN, the Incorrect PIN extension is executed. All other disapprovals are reported to the session, which initiates the Failed Transaction Extension. The bank is notified whether or not an approved transaction was completed in its entirety by the machine; if it is completed then the bank completes debiting the customer's account for the amount.

Deposit Transaction Use Case

A deposit transaction is started from within a session when the customer chooses deposit from the menu of possible transaction types. The customer chooses a type of account to deposit to (e.g. checking) from a menu of possible accounts, and then chooses a dollar amount by typing it on the keyboard. The system sends the customer's card number, PIN, chosen account and amount to the bank, which either approves or disapproves the transaction. If the transaction is approved, the machine accepts an envelope from the customer containing cash and/or checks and then issues a receipt. (If the customer does not insert the envelope within a specified period of time, this operation times out and the deposit transaction is aborted.) If the transaction is disapproved due to an incorrect PIN, the Incorrect PIN extension is executed. All other disapprovals are reported to the session, which initiates the Failed Transaction Extension. The bank is notified whether or not an approved transaction was completed in its

entirety by the machine; if it is completed then the bank completes crediting the customer's account for the amount - contingent on manual verification of the deposit envelope contents by an operator later.

Transfer Transaction Use Case

A transfer transaction is started from within a session when the customer chooses transfer from the menu of possible transaction types. The customer chooses a type of account to transfer from (e.g. checking) from a menu of possible accounts, chooses a different account to transfer to, and then chooses a dollar amount by typing it on the keyboard. The system sends the customer's card number, PIN, chosen account and amounts to the bank, which either approves or disapproves the transaction. If the transaction is approved, the machine issues a receipt. If the transaction is disapproved due to an incorrect PIN, the Incorrect PIN extension is executed. All other disapprovals are reported to the session, which initiates the Failed Transaction Extension. The bank will consider the transaction complete once it has been approved.

Balance Inquiry Transaction Use Case

A balance inquiry transaction is started from within a session when the customer chooses balance inquiry from the menu of possible transaction types. The customer chooses a type of account to inquire about. The system sends the customer's card number, PIN and chosen account to the bank, which either approves or disapproves the transaction. If the transaction is approved the bank sends the balance to the machine with the approval, and the system prints it on a receipt. If the transaction is disapproved due to an incorrect PIN, the Incorrect PIN extension is executed. All other disapprovals are reported to the session, which initiates the Failed Transaction Extension.

Invalid PIN Extension

An invalid PIN extension is started from within a transaction when the bank reports that the customer's transaction is disapproved due to an invalid PIN. The customer is required to re-enter the PIN and the original request is sent to the bank again. If the bank now approves the transaction, or disapproves it for some other reason, the original case is continued; otherwise the process of re-entering the PIN is repeated. Once the PIN is successfully re-entered, it is used for both the current transaction and all subsequent transactions in the session. If the customer fails three times to enter the correct PIN, the card is permanently retained, a screen is displayed informing the customer of this and suggesting he/she contact the bank, and the entire customer session is aborted.

Failed Transaction Extension

A failed transaction extension is started from a session when a transaction use case fails to complete successfully for some reason other than repeated entries of an invalid PIN. A screen is displayed

informing the customer of the problem, and the customer is asked whether he/she wants to do another transaction.