25.5 Identifying Class Attributes

Class	Descriptive words and phrases
ATM	user is authenticated
BalanceInquiry	account number
Withdrawal	account number amount
Deposit	account number amount
BankDatabase	[no descriptive words or phrases]
Account	account number PIN balance
Screen	[no descriptive words or phrases]
Keypad	[no descriptive words or phrases]
CashDispenser	begins each day loaded with 500 $20 bills
DepositSlot	[no descriptive words or phrases]

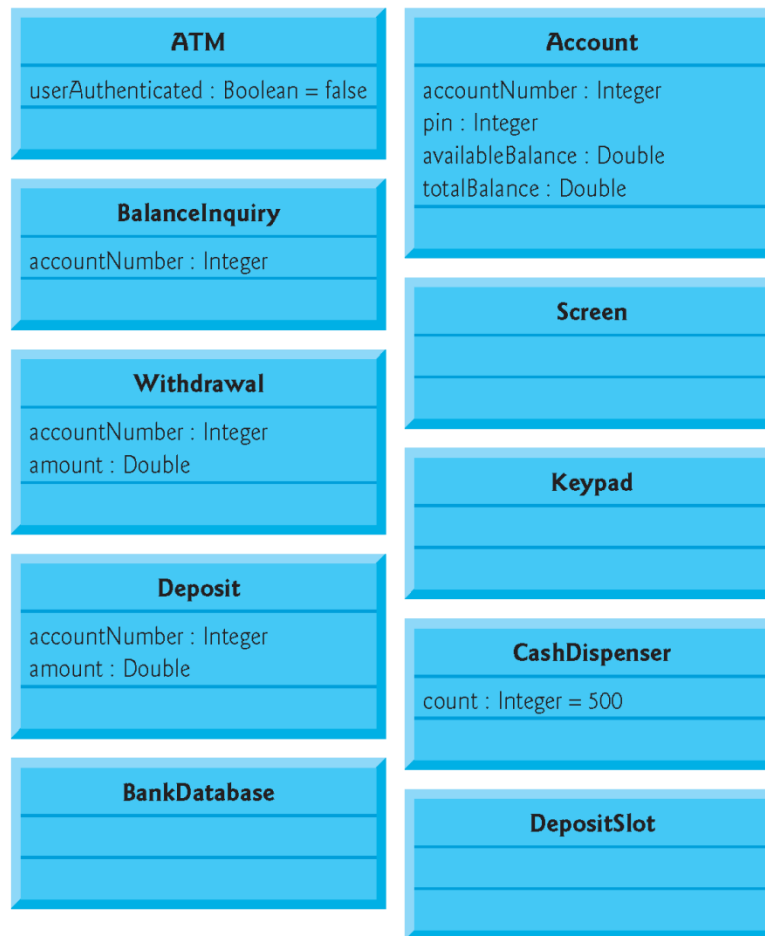**Fig. 25.11** | Descriptive words and phrases from the ATM requirements.

Fig. 25.12 | Classes with attributes.

Software Engineering Observation 25.1

At the early stages in the design process, classes often lack attributes (and operations). Such classes should not be eliminated, however, because attributes (and operations) may become evident in the later phases of design and implementation.

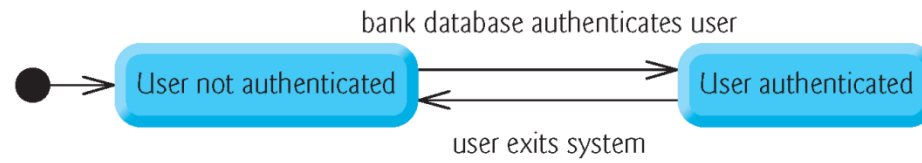# 25.6 Identifying Objects' States and Activities

Fig. 25.13 | State diagram for the ATM object.

Software Engineering Observation 25.2

Software designers do not generally create state diagrams showing every possible state and state transition for all attributes—there are simply too many of them. State diagrams typically show only the most important or complex states and state transitions.
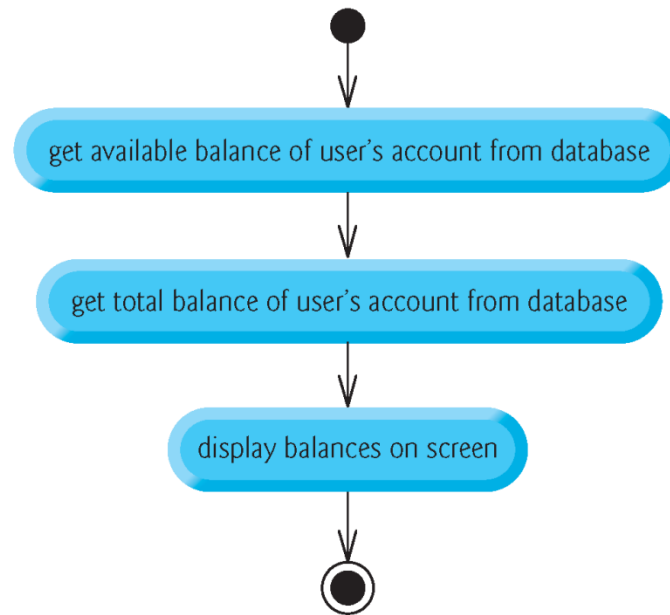
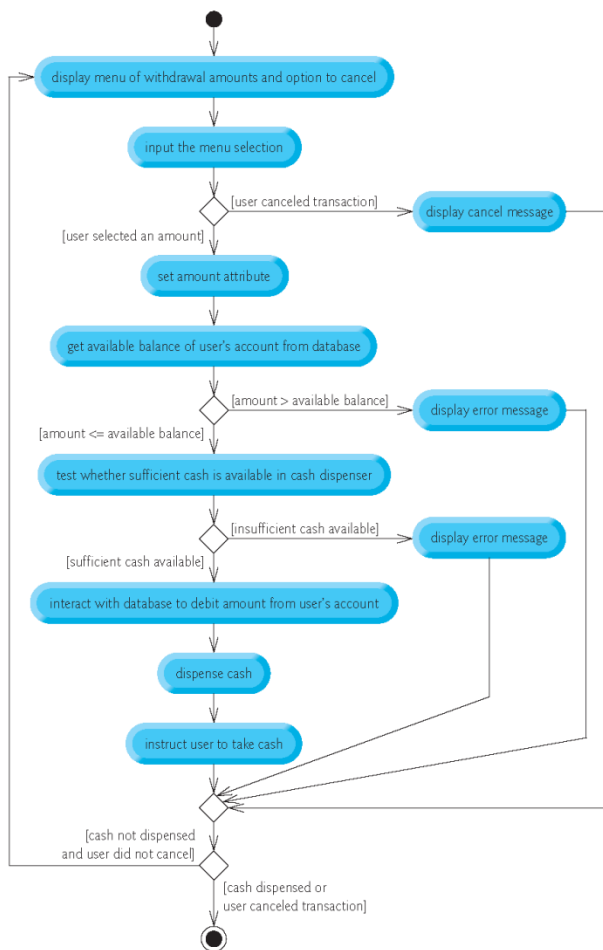**Fig. 25.14** | Activity diagram for a `BalanceInquiry` transaction.

Fig. 25.15 | Activity diagram for a `Withdrawal` transaction.

25.7 Identifying Class Operations

Class	Verbs and verb phrases
ATM	executes financial transactions
BalanceInquiry	[none in the requirements document]
Withdrawal	[none in the requirements document]
Deposit	[none in the requirements document]
BankDatabase	authenticates a user, retrieves an account balance, credits a deposit amount to an account, debits a withdrawal amount from an account
Account	retrieves an account balance, credits a deposit amount to an account, debits a withdrawal amount from an account
Screen	displays a message to the user
Keypad	receives numeric input from the user
CashDispenser	dispenses cash, indicates whether it contains enough cash to satisfy a withdrawal request
DepositSlot	receives a deposit envelope

Fig. 25.16 | Verbs and verb phrases for each class in the ATM system.

ATM

userAuthenticated : Boolean = false

BalanceInquiry

accountNumber : Integer

execute()

Withdrawal

accountNumber : Integer
amount : Double

execute()

Deposit

accountNumber : Integer
amount : Double

execute()

BankDatabase

authenticateUser() : Boolean
getAvailableBalance() : Double
getTotalBalance() : Double
credit()
debit()

Account

accountNumber : Integer
pin : Integer
availableBalance : Double
totalBalance : Double

validatePIN() : Boolean
getAvailableBalance() : Double
getTotalBalance() : Double
credit()
debit()

Screen

displayMessage()

Keypad

getInput() : Integer

CashDispenser

count : Integer = 500

dispenseCash()
isSufficientCashAvailable() : Boolean

DepositSlot

isEnvelopeReceived() : Boolean

Fig. 25.17 | Classes in the ATM system with attributes and operations.
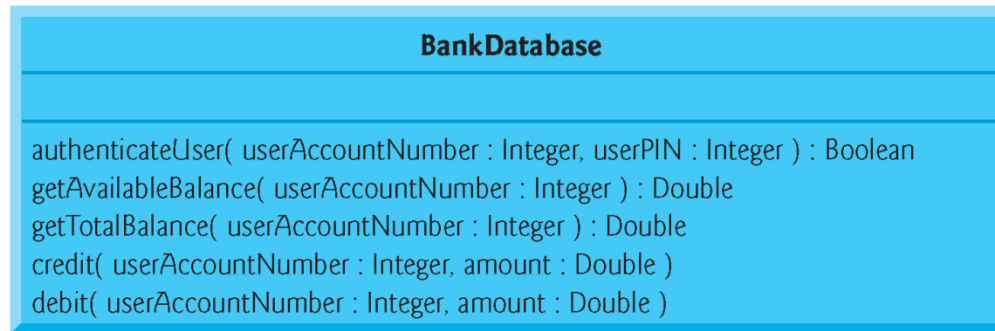
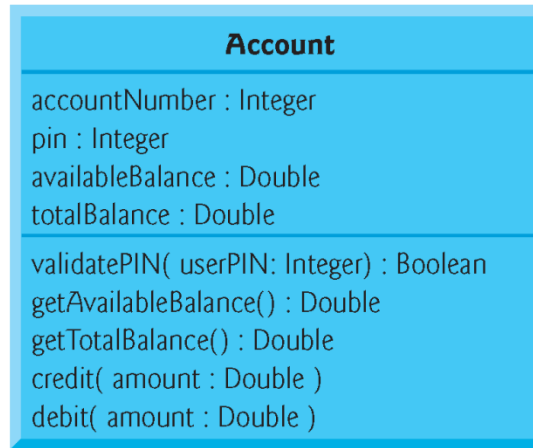**Fig. 25.18** | Class `BankDatabase` with operation parameters.
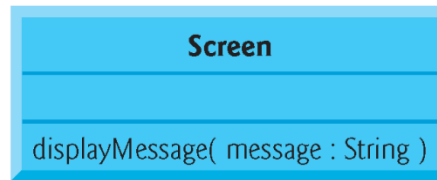
Fig. 25.19 | Class `Account` with operation parameters.

Fig. 25.20 | Class Screen with operation parameters.