

Shah

Solution

**COMP 3700.002**  
**Software Modeling and Design**  
**Midterm Exam-I**

**Maximum Points: 100**

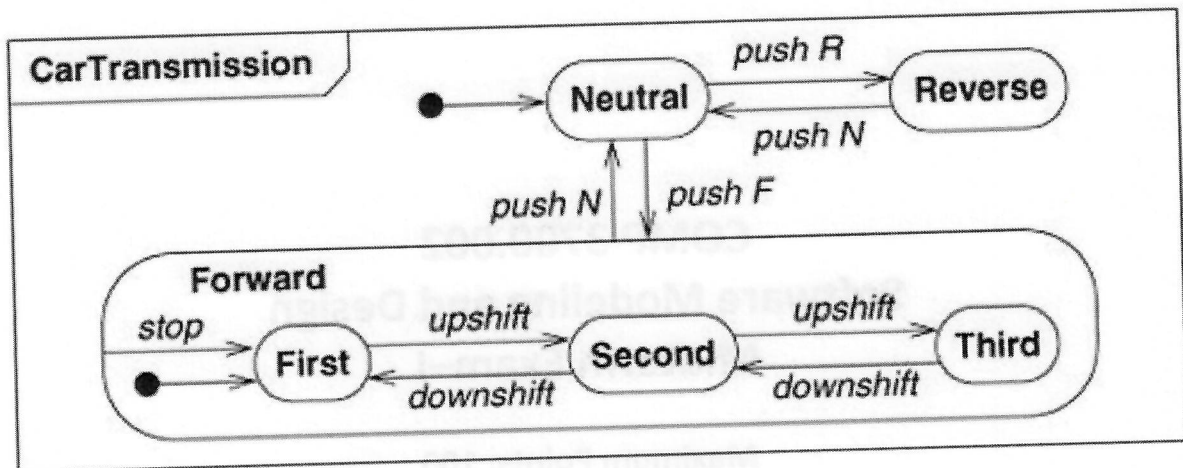
**Exam Duration: 50 Minutes**

**Spring 2020**

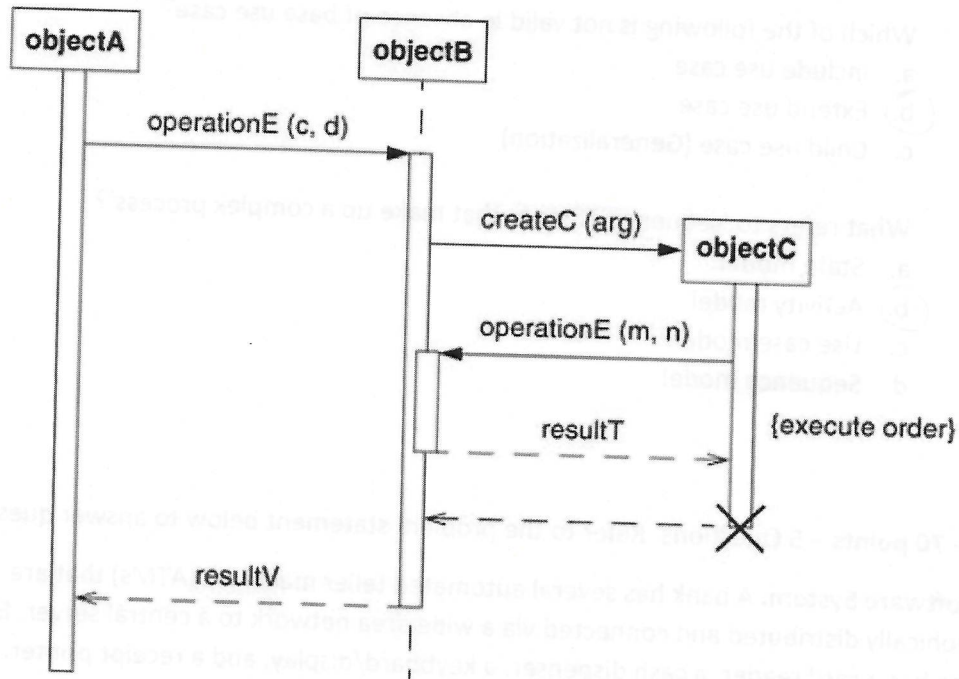
**Instructions:** Write and draw neatly and clearly. If we can't read it, you will NOT get credit even if it is correct. Do not spend too much time on any one question – move on, and come back to it later if you have time. Use back sides of sheets if you need more space. If explanations are asked for, these should be brief but precise.

Name: Shaik, Shehenaz

**Part A - 30 points** – 10 Multiple Choice Questions (3 points each): Circle one correct answer; If more than one answer is circled, you will not get any credit.



- Refer to Figure above. What is the target state of object upon event 'Push F' in state 'Neutral'?
  - ☒ First
  - ☐ Second
  - ☐ Third
  - ☐ Reverse
- Refer to Figure above. What is the target state of object upon event 'Stop' in state 'First'?
  - ☒ First
  - ☐ Second
  - ☐ Third
  - ☐ Neutral
- Which of these is not inherited by a subclass?
  - ☐ Class model
  - ☐ State model
  - ☐ Interaction model
  - ☒ None of the above
- What represents a fork of control for concurrent activities in activity diagram
  - ☐ Diamond
  - ☒ Heavy bar
  - ☐ Elongated oval
  - ☐ Solid circle with an outgoing arrow



5. Refer to Figure above. '{execute order}' can be identified as \_\_\_\_\_.
  - a. Event
  - b. Transition
  - ☒ c. Activity
  - d. Signal
6. Refer to Figure above. Which term more accurately describes 'objectC'?
  - a. Active object
  - b. Passive object
  - c. Concurrent object
  - ☒ d. Transient object
7. Which of the following provides holistic view of behavior across many objects?
  - a. Class model
  - b. State model
  - ☒ c. Interaction model
  - d. None of the above
8. Multiple inheritance is allowed with which of the following?
  - ☒ a. Classes only
  - b. Use cases only
  - c. Both classes and use cases
  - d. Neither of them

9. Which of the following is not valid in absence of base use case?
- a. Include use case
  - ☒ b. Extend use case
  - c. Child use case (Generalization)
10. What refers to 'sequence of steps that make up a complex process'?
- a. State model
  - ☒ b. Activity model
  - c. Use case model
  - d. Sequence model

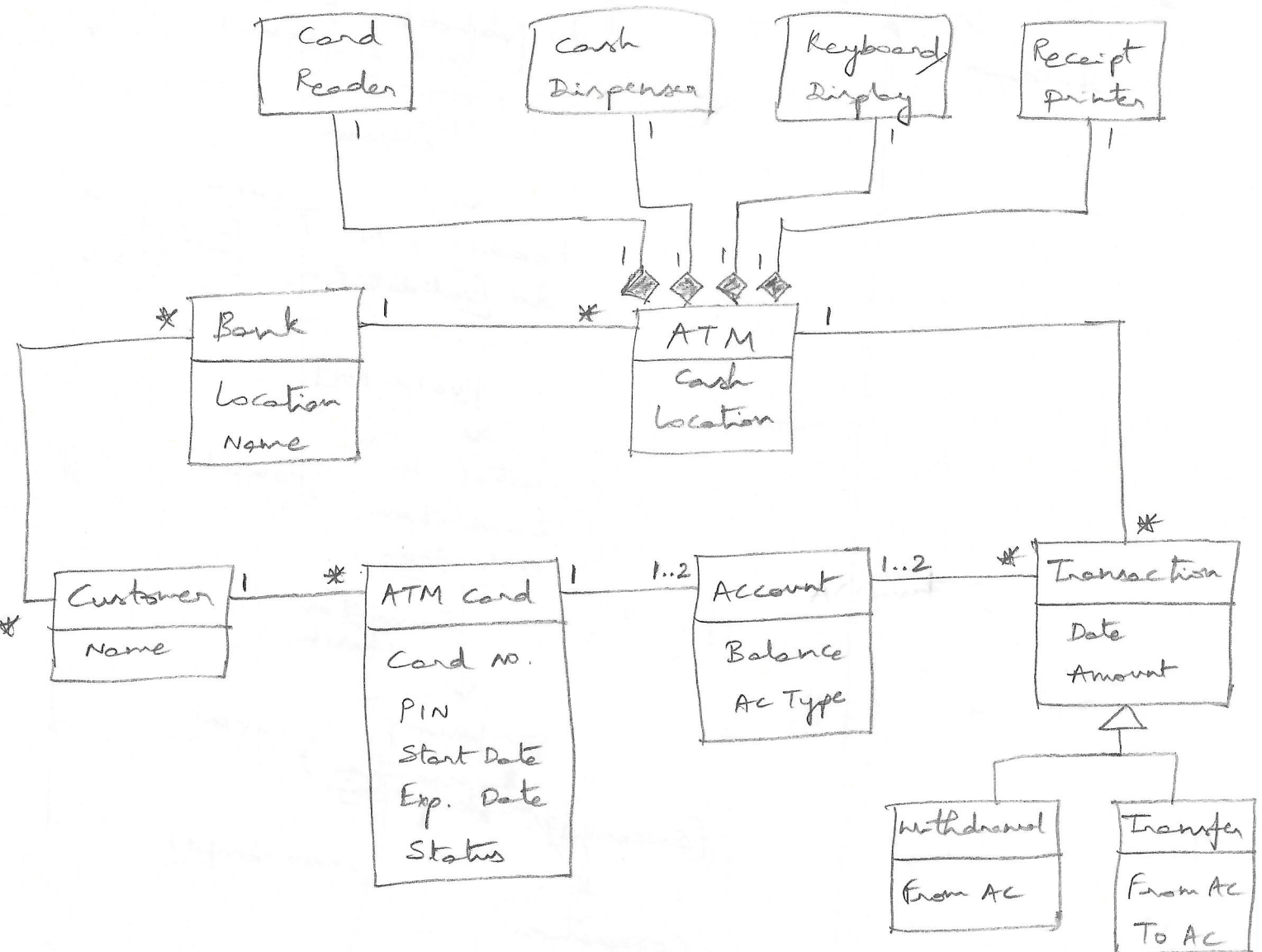
**Part B - 70 points** – 5 Questions. Refer to the problem statement below to answer questions.

**ATM Software System.** A bank has several automated teller machines (ATMs) that are geographically distributed and connected via a wide area network to a central server. Each ATM machine has a card reader, a cash dispenser, a keyboard/display, and a receipt printer. By using the ATM machine, a customer can withdraw cash from either a checking or savings account, query the balance of an account, or transfer funds from one account to another. A transaction is initiated when a customer inserts an ATM card into the card reader. Encoded on the magnetic strip on the back of the ATM card are the card number, the start date, and the expiration date. System validates the ATM card to determine that the expiration date has not passed, that the user-entered personal identification number, or PIN, matches the PIN maintained by the system, and that the card is not lost or stolen. If the PIN is validated satisfactorily, the customer is prompted for a withdrawal, query, or transfer transaction. Before a withdrawal transaction can be approved, the system determines that sufficient funds exist in the requested account, and that there are sufficient funds at the local cash dispenser. If the transaction is approved, the requested amount of cash is dispensed, a receipt is printed that contains information about the transaction, and the card is ejected. Before a transfer transaction can be approved, the system determines that the customer has at least two accounts and that there are sufficient funds in the account to be debited. For approved query and transfer requests, a receipt is printed, and the card ejected. A customer may cancel a transaction at any time; the transaction is terminated, and the card is ejected. Customer records, account records, and debit card records are all maintained at the server. An ATM operator may start up and close down the ATM to replenish the ATM cash dispenser and for routine maintenance.

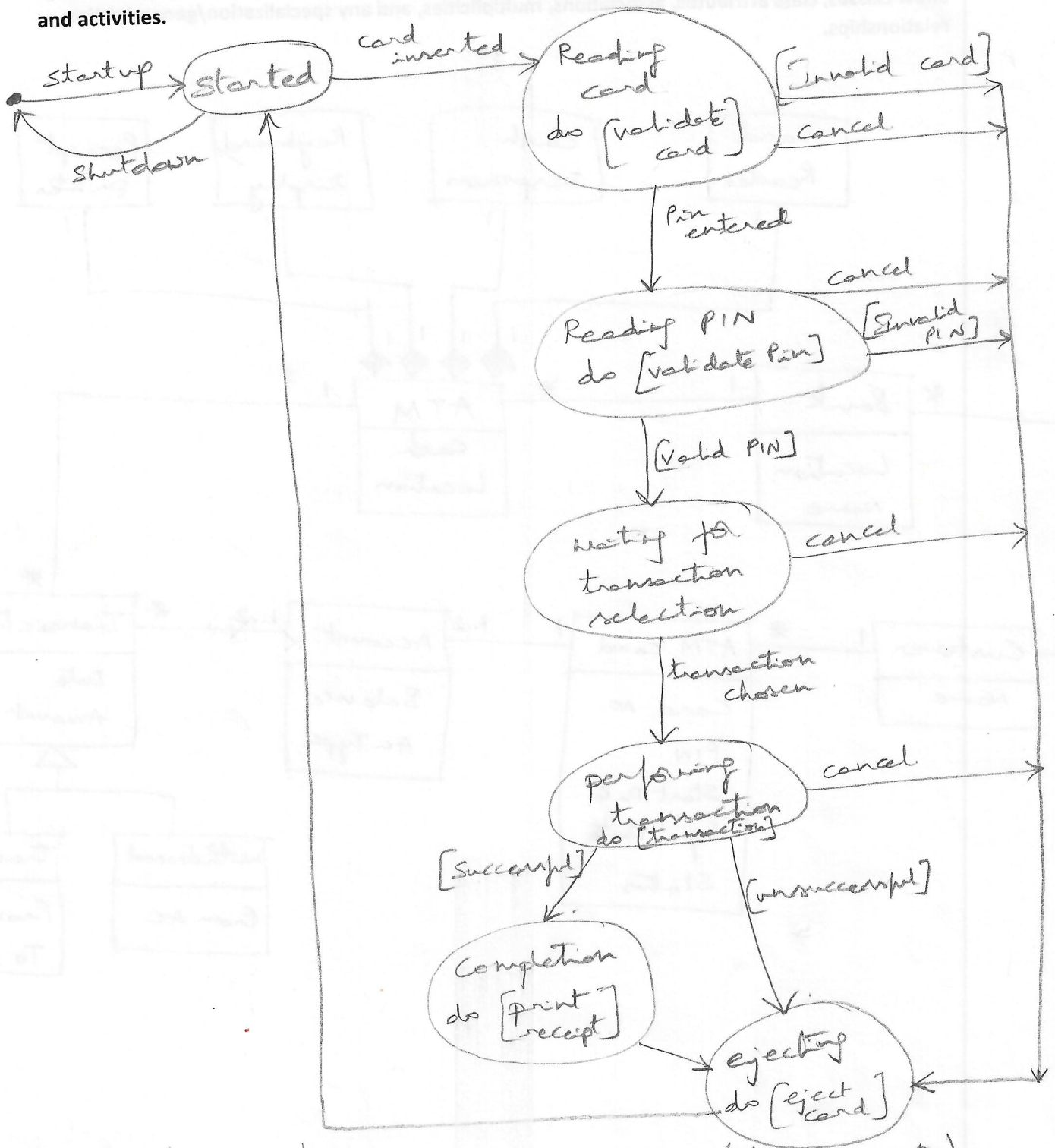
**Note:** It is assumed that functionality to open and close accounts and to create, update, and delete customer and debit card records is provided by an existing system and is not part of this problem.



Question B-1: (25 Points) Draw class diagram for the ATM software system described above. Show classes, class attributes, associations, multiplicities, and any specialization/generalization relationships.



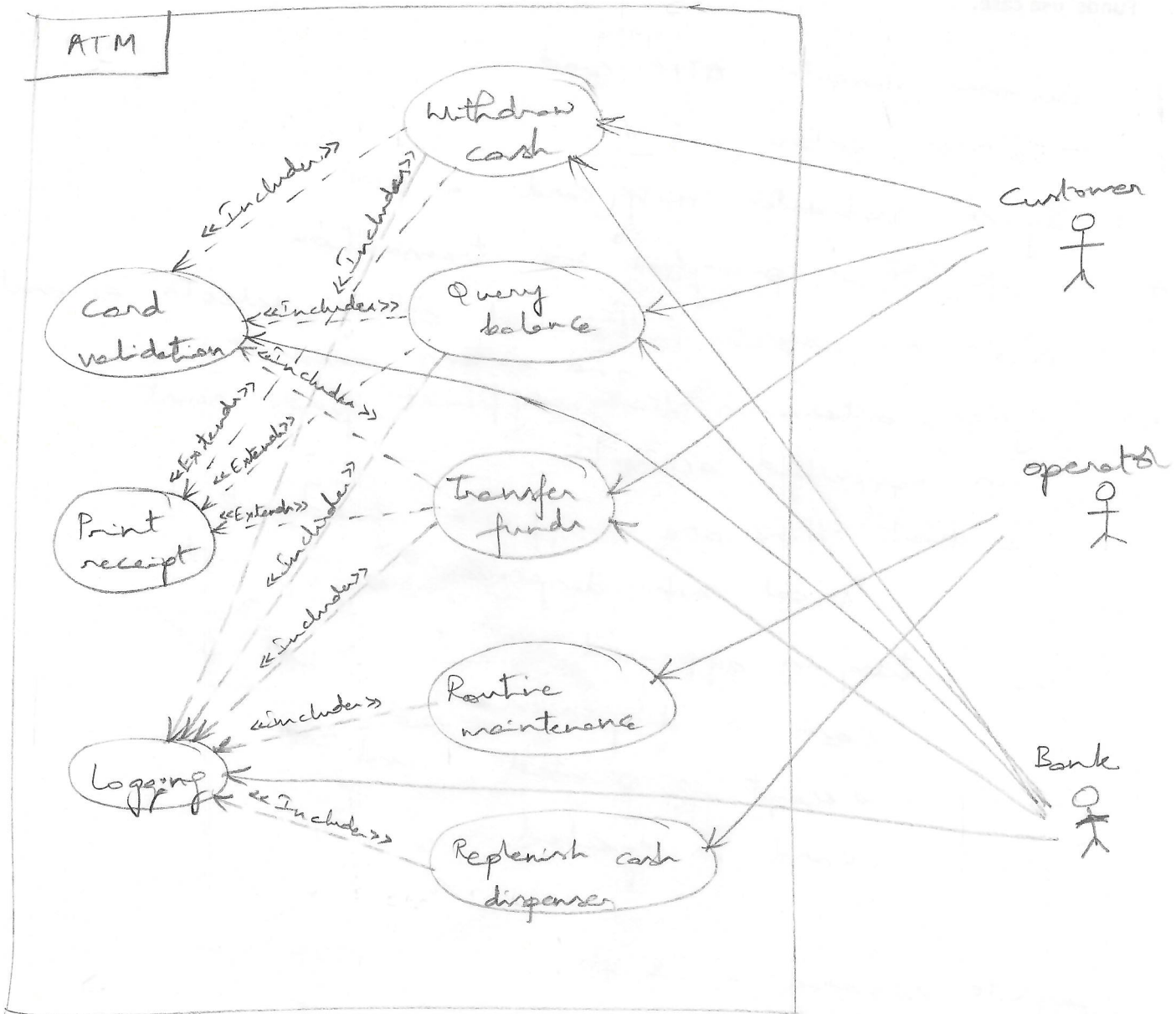
Question B-2: (20 Points) Draw state diagram for the ATM class. Show states, events, transitions, and activities.



Startup/ shutdown missing / Ignored  
 cancel missing  
 Mostly correct (Minor error) → (-5) pts  
 -1 pt  
 -2 pts  
 Incorrect format → (+1) pt

Incomplete (+10 pts)  
 Partially correct (+5 pts)

Question B-3: (5 Points) Draw use case diagram.



Use cases	(5)	→	3 pt	operator & to use cases mining → 2 pt
	3	→	2 pt	
Actor	2/3	→	1 pt	action inside box → -1/2 pt
	1	→	1/2 pt	
links		→	1 pt	
(Mining links to actor)		→	1/2 pt	

Question B-4: (5 Points) Describe a scenario associated with normal behavior for 'Withdraw Funds' use case.

1. Customer inserts ATM card
2. Customer enters PIN
3. System validates ATM Card & PIN.
4. Customer is prompted for transaction
5. Customer selects withdrawal option, selects account, and enters amount
6. System determines that sufficient funds exist in requested account & that there are sufficient funds at local cash dispenser
7. Transaction is approved, cash is dispensed, receipt is printed, and card is ejected.

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Complete scenario - 5 pts

Starts at option selection - 4 pts

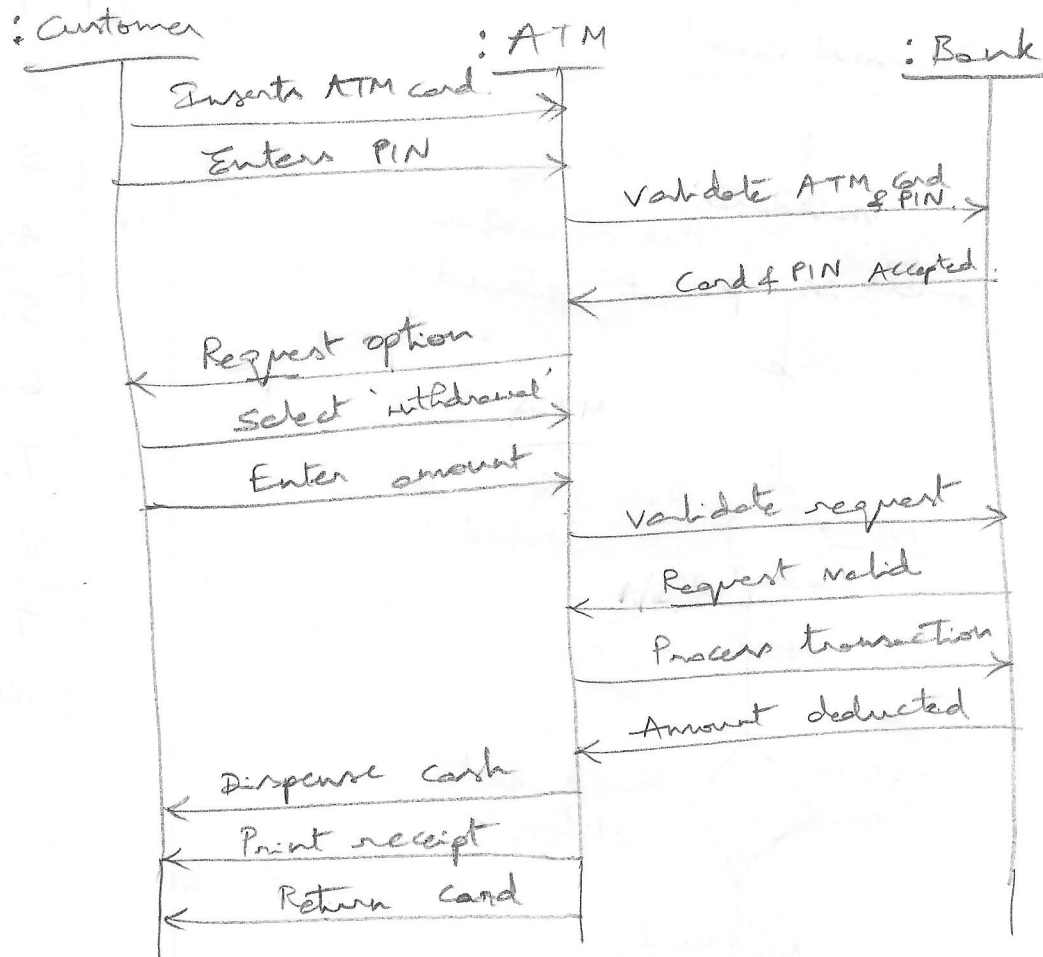
(5) Some steps missing

Several steps missing - 3 pts.

Some steps - 2 pts



Question B-5: (15 Points) Construct sequence diagram for the scenario described in Question B-4. Make sure the scenario and its sequence diagram are consistent.



Bank/ object missing → (-1)

AC  
Missed card → (-1)

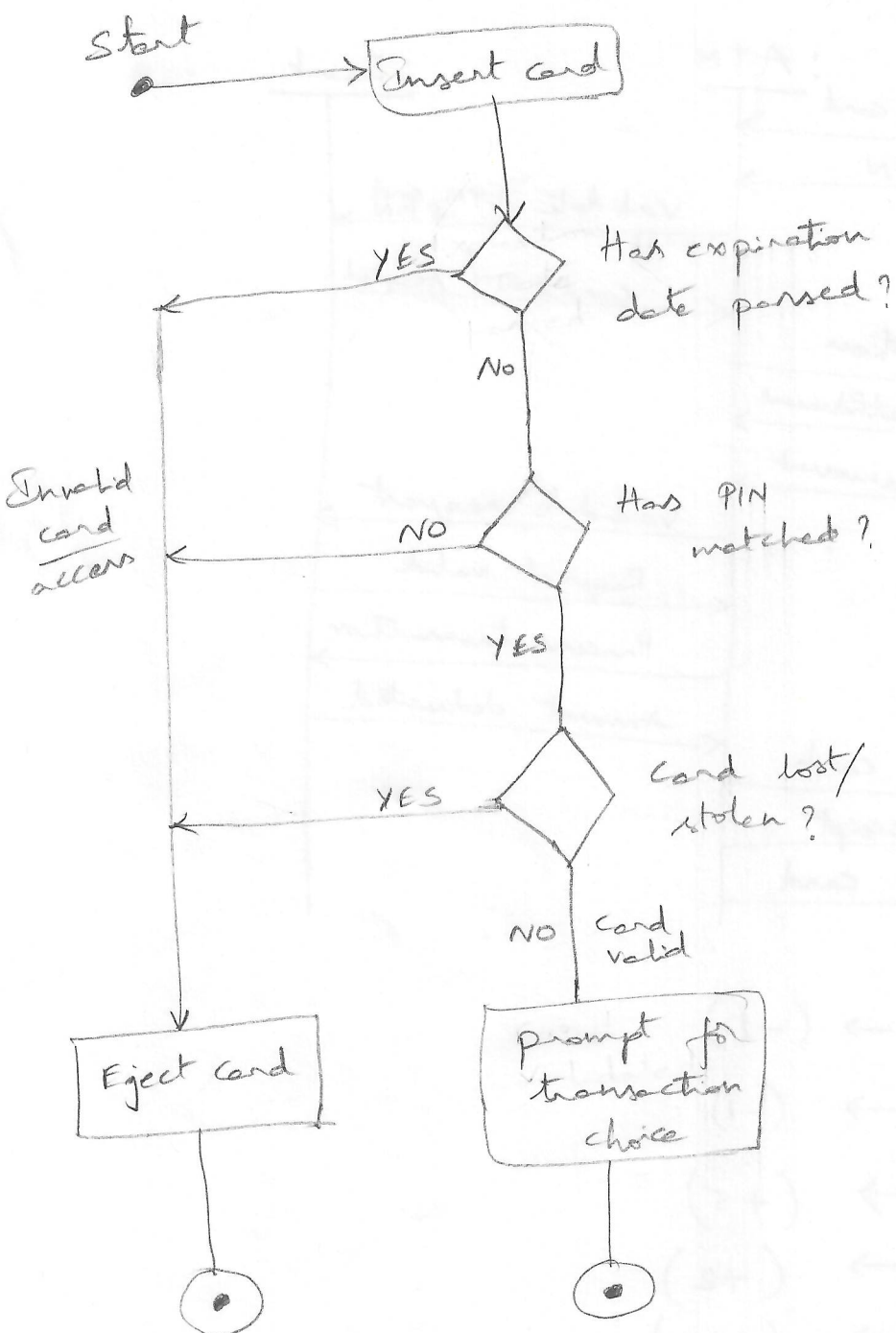
object only → (+5)

Incorrect format → (+2)

lifelines missing → (+10)

Partially correct → (+8)

Question B-6: (BONUS - 10 Points) Draw activity diagram for the activity – ATM card validation.



- |       |
|-------|
| 1. A  |
| 2. A  |
| 3. D  |
| 4. B  |
| 5. C  |
| 6. D  |
| 7. C  |
| 8. A  |
| 9. B  |
| 10. B |

Two conditions only → 8 pts  
 Minor error → 9 pts  
 Partially correct →  $\frac{6 \text{ pts}}{4 \text{ pts}}$   
 Incorrect format → 2 pt.