



Testing With Use Cases

Lecture Objectives:

- 1) Explain the purpose of the use case diagram.
- 2) Given a use case scenario, construct an activity diagram showing the flow through the use case.
- 3) Given an activity diagram, construct a set of test cases to fully exercise the use case.

Use Cases and Use case

Diagrams

- Use Case
 - A named capability of a structural entity within a system

- Explanation of how someone would use the system or a capability of the system

User

Scenarios / Flows through a system.

- Use Case Diagram

- A diagram showing use cases and the relationship with Actors

- Actor

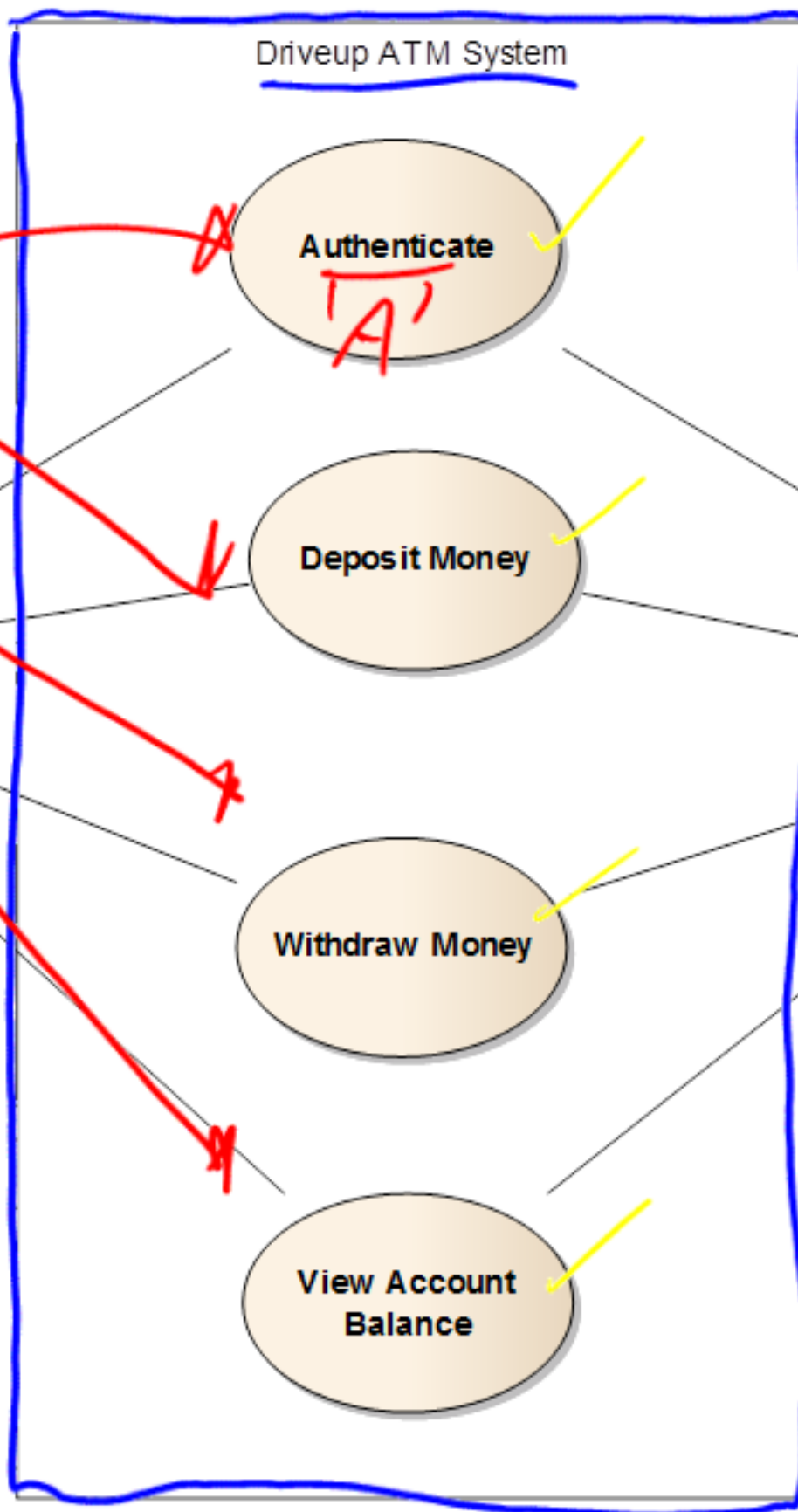
- An external entity which interacts with the system

Actors in the use case.

Use Case

Use Cases

Actors



Scope of the system simulate

Actors

Elaboration

- Use cases are commonly elaborated (or documented)
- Elaboration is first written textually
 - Details of operation - what happens in specific
 - Alternatives model choices and conditions during execution

↳ branches/decisions/
etc.

Elaboration of ATM Use Case

- Use Case Name : Authenticate *Matches 'A' on diagram*
- Summary : Customer uses a valid card to authenticate themselves with the ATM system, thus allowing other transactions to occur. *→ High level.*
- Actors : ATM Customer, Bank Account Management System *⇒ implements with.*
- Precondition : ATM is displaying the idle welcome message
- Description : *what must drive to start.*
 1. Customer inserts an ATM Card into the ATM Card Reader.
 2. If the system can recognize the card, it reads the card number.
 3. System prompts the customer for a PIN.
 4. Customer enters PIN.
 5. System checks the card's expiration date and whether the card has been stolen or lost.
 6. If the card is valid, the system checks if the entered PIN matches the card PIN.
 7. If the PINs match, the system allows the user to access the ATM.

steps through the use case.

Elaboration of ATM Use Case

- Use Case Name : Authenticate
- Summary : Customer uses a valid card to authenticate themselves with the ATM system, thus allowing other transactions to occur.
- Actor : ATM Customer, Bank Account Management System
- Precondition : ATM is displaying the idle welcome message
- Description :
 1. Customer inserts an ATM Card into the ATM Card Reader. —
 2. If the system can recognize the card, it reads the card number. ~~2~~
 3. System prompts the customer for a PIN. 2
 4. Customer enters PIN. 3
 5. ~~System~~ System checks the card's expiration date and whether the card has been stolen or lost. 4/
 6. If the card is valid, the system checks if the entered PIN matches the card PIN. 6
 7. If the PINs match, the system allows the user to access the ATM. 7

Elaboration of ATM Use Case – (2/2)

- Alternatives:

- If the system cannot recognize the card, it is ejected and the welcome message is displayed. ✓
- If the current date is past the card's expiration date, the card is confiscated and the welcome message is displayed.
- If the card has been reported lost or stolen, it is confiscated and the welcome message is displayed.
- If the customer entered PIN does not match the PIN for the card, the system prompts for a new PIN.
- If the customer enters an incorrect PIN three times, the card is confiscated and the welcome message is displayed.

- Postcondition:

- User is allowed to access the system.

Elaboration of ATM Use Case – (2/2)

• Alternatives:

- 1 – If the system cannot recognize the card, it is ejected and the welcome message is displayed.
- 2 – If the current date is past the card's expiration date, the card is confiscated and the welcome message is displayed.
- 3 – If the card has been reported lost or stolen, it is confiscated and the welcome message is displayed.
- 4 – If the customer entered PIN does not match the PIN for the card, the system prompts for a new PIN.
- If the customer enters an incorrect PIN three times, the card is confiscated and the welcome message is displayed.

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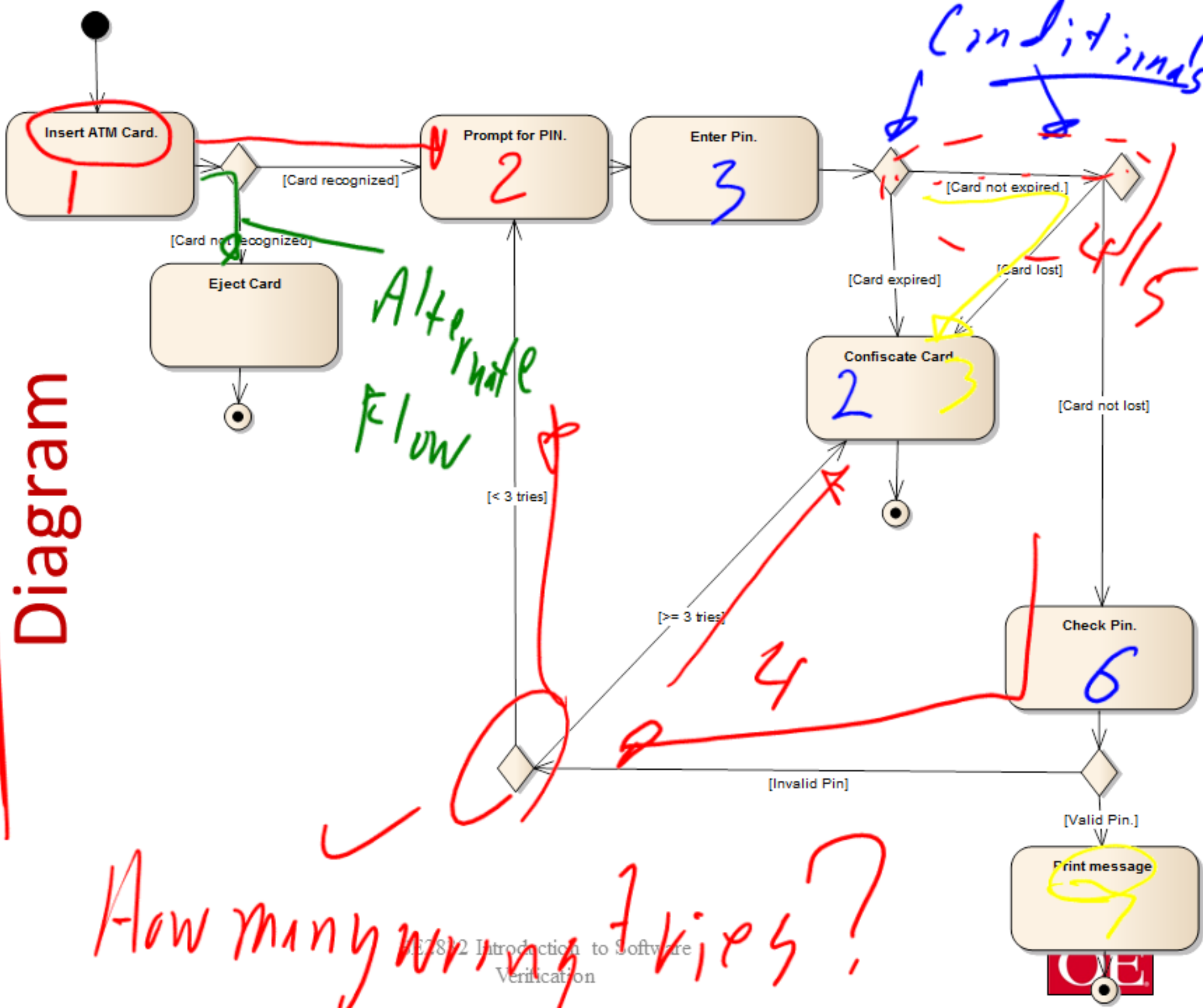
Use Cases to Activity Diagrams

- Activity diagrams indicate flow among activities
- Activities should model user level steps
- Two kinds of nodes:
 - Action states
 - Sequential branches
- Use case descriptions become action state nodes in the activity diagram
 - Alternatives are sequential branch nodes
 - Flow among steps are edges

movement through the activities

between

Authenticate Activity Diagram

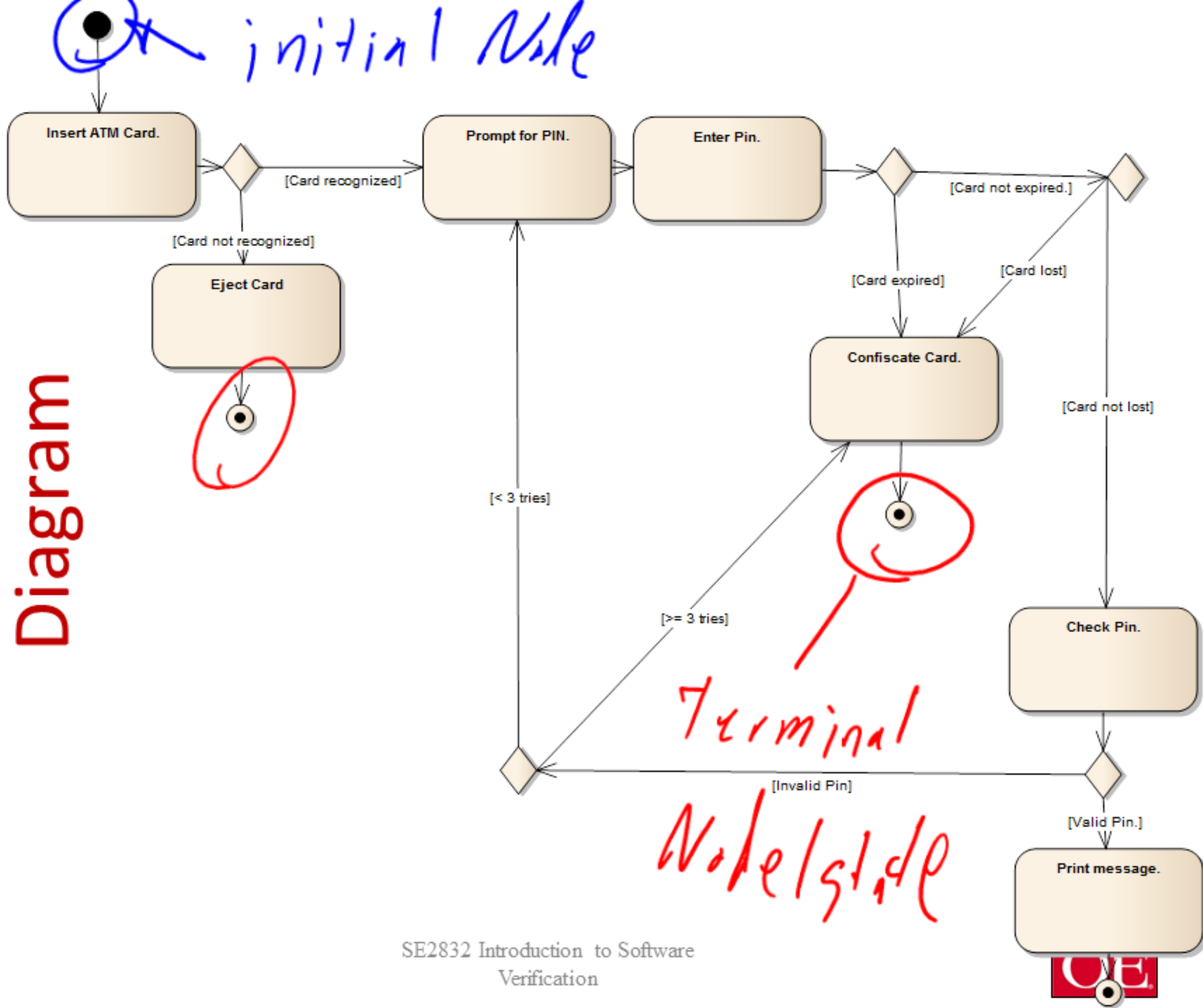


How many wrong tries?



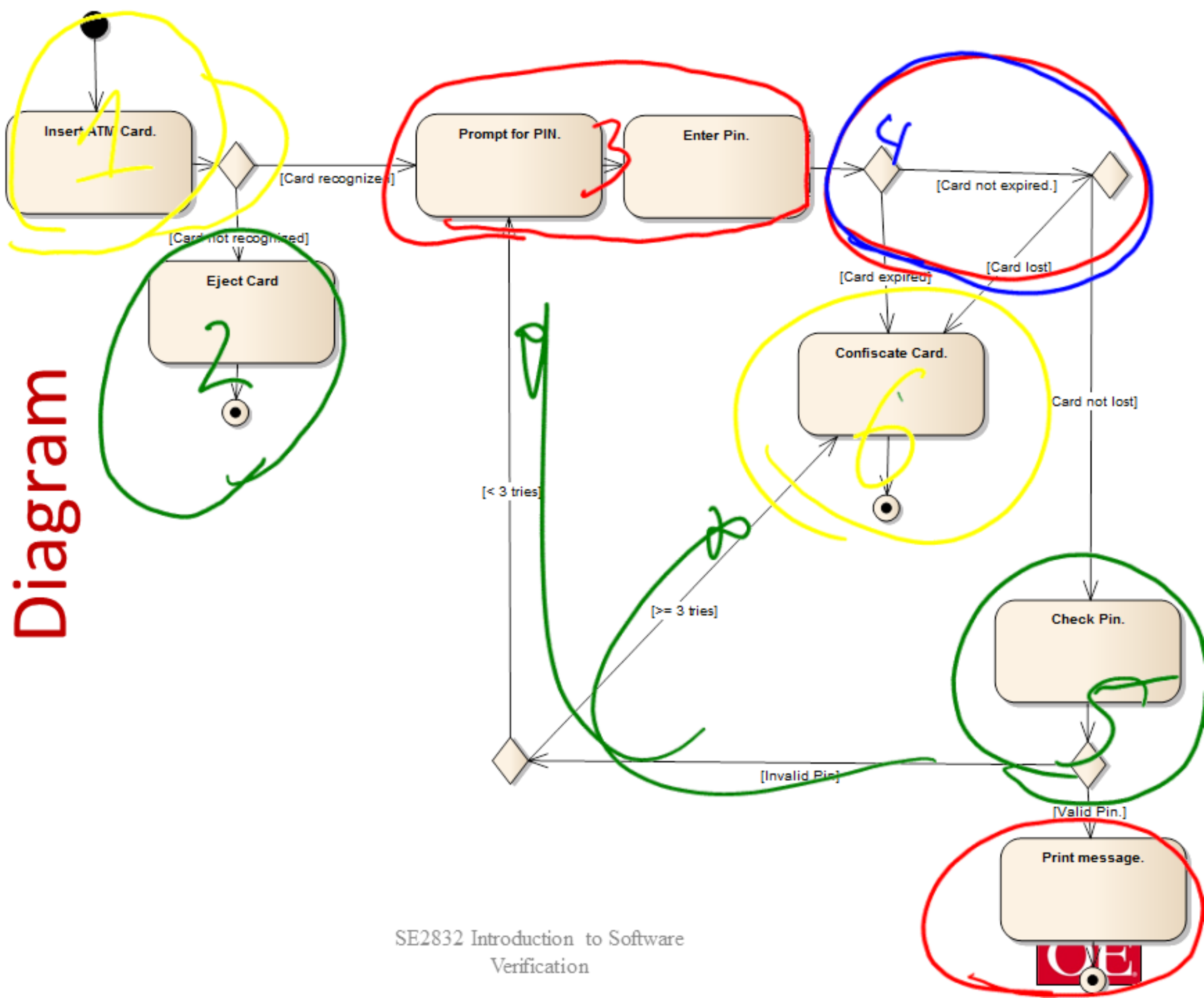
Authenticate Activity

Diagram

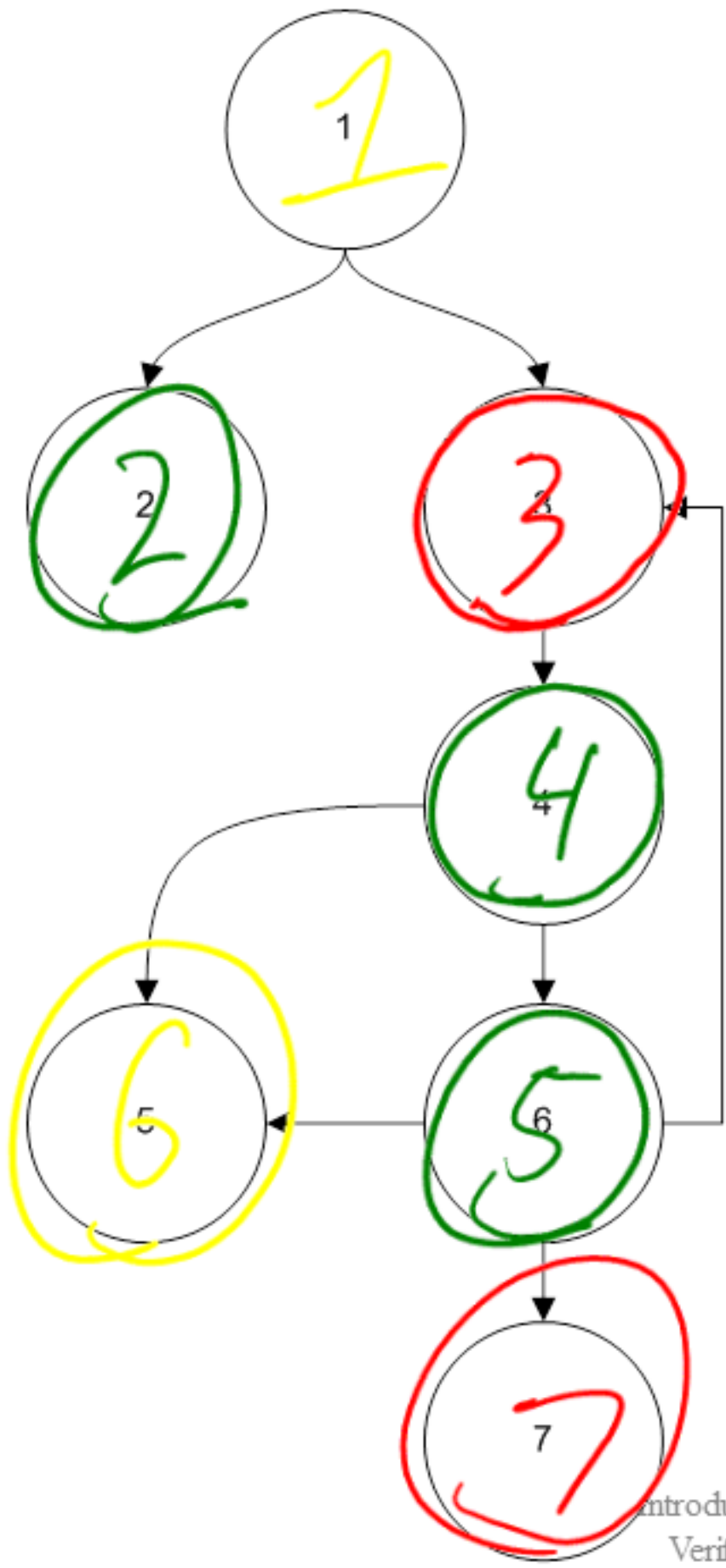


Authenticate Activity

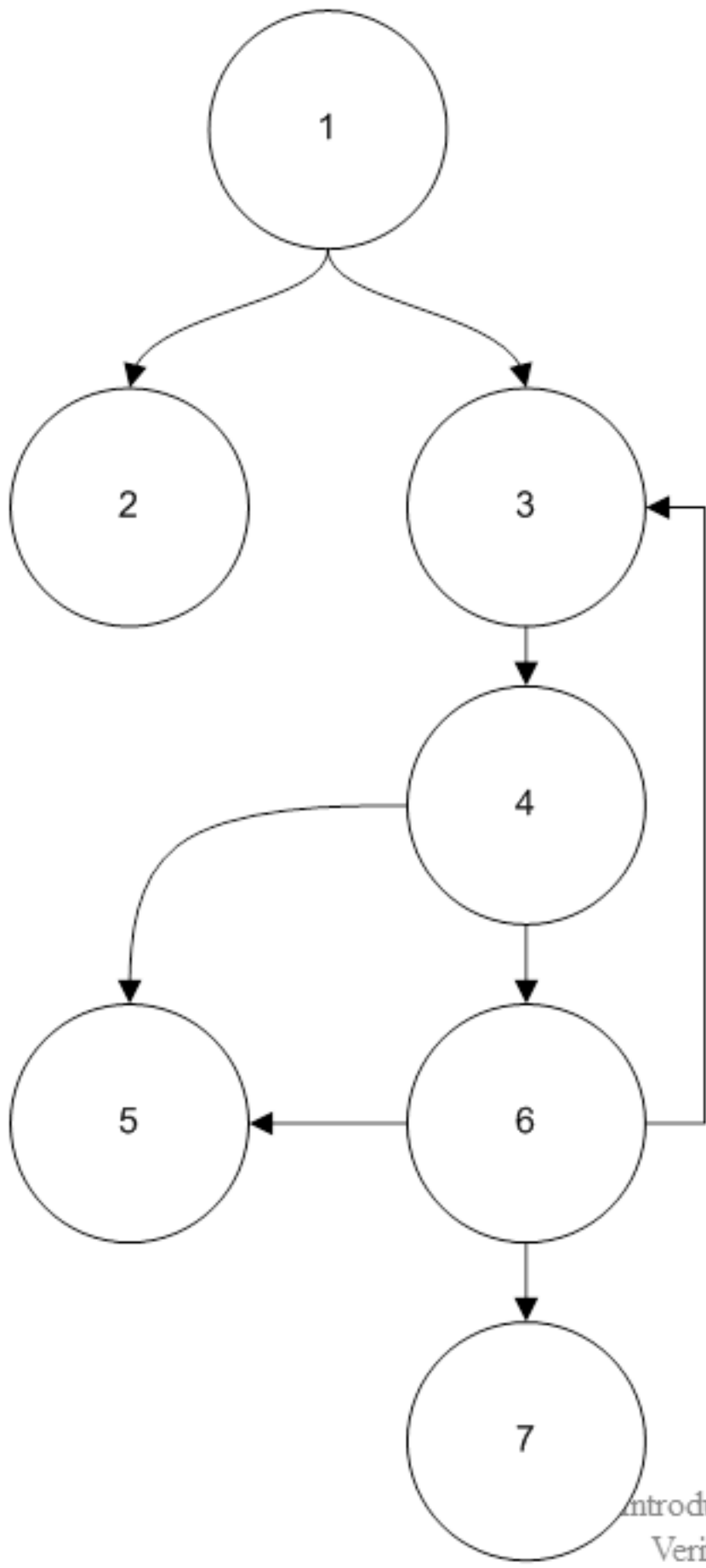
Diagram







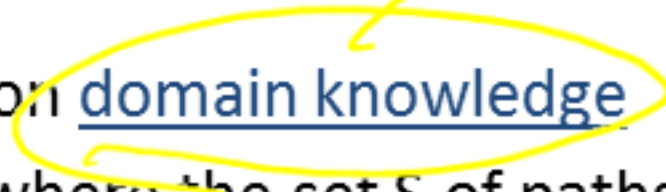
A graph from the activity diagram



A graph from the activity diagram

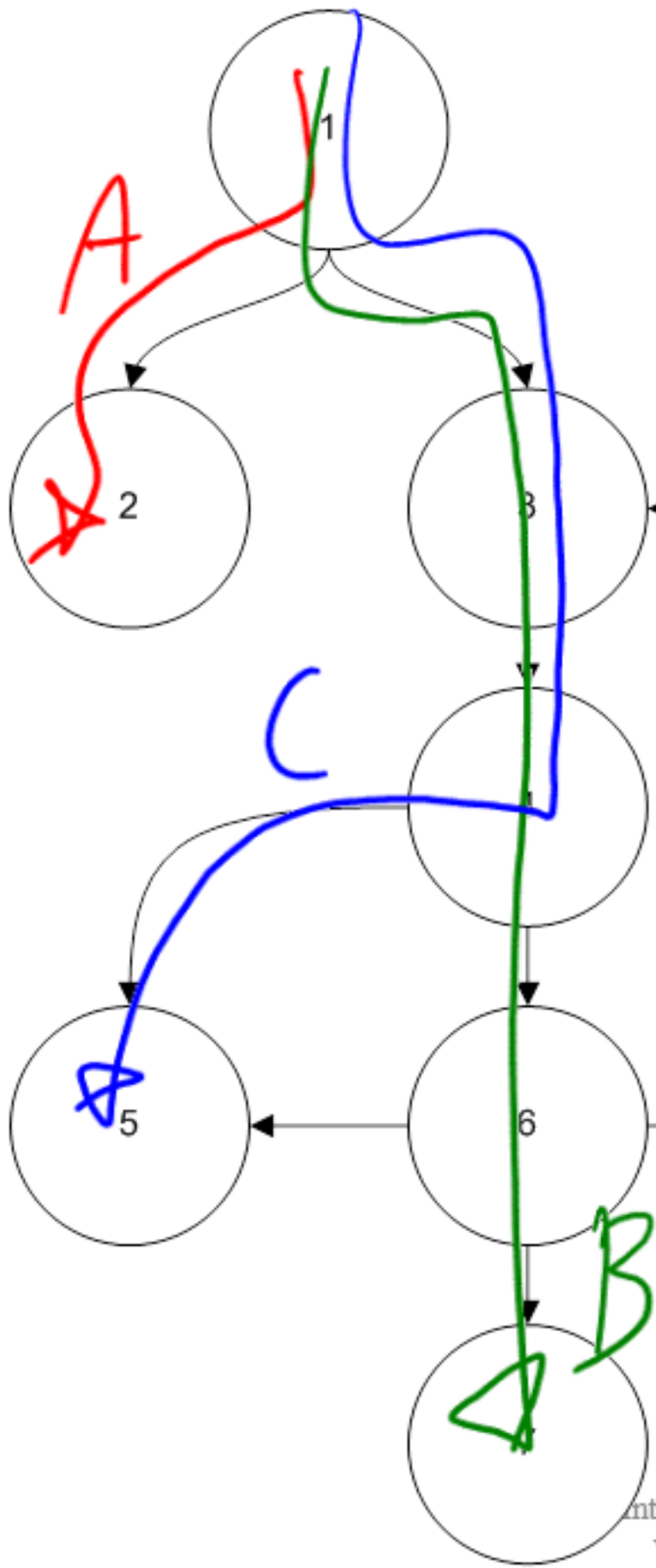


Covering Activity Graphs

- Node Coverage 
 - Inputs to the software are derived from labels on nodes and predicates
 - Used to from test case values 
- Edge Coverage 
- Scenario Testing  Use case based testing
 - Scenario : A complete path through a use case activity graph
 - Should make semantic sense to the users
 - Number of paths often finite
 - If not, scenarios defined based on domain knowledge  System
 - Use "specified path coverage", where the set S of paths is the set of scenarios
 - Note that specified path coverage does not necessarily subsume edge coverage, but scenarios should be defined so that it does

Scenarios cover everything

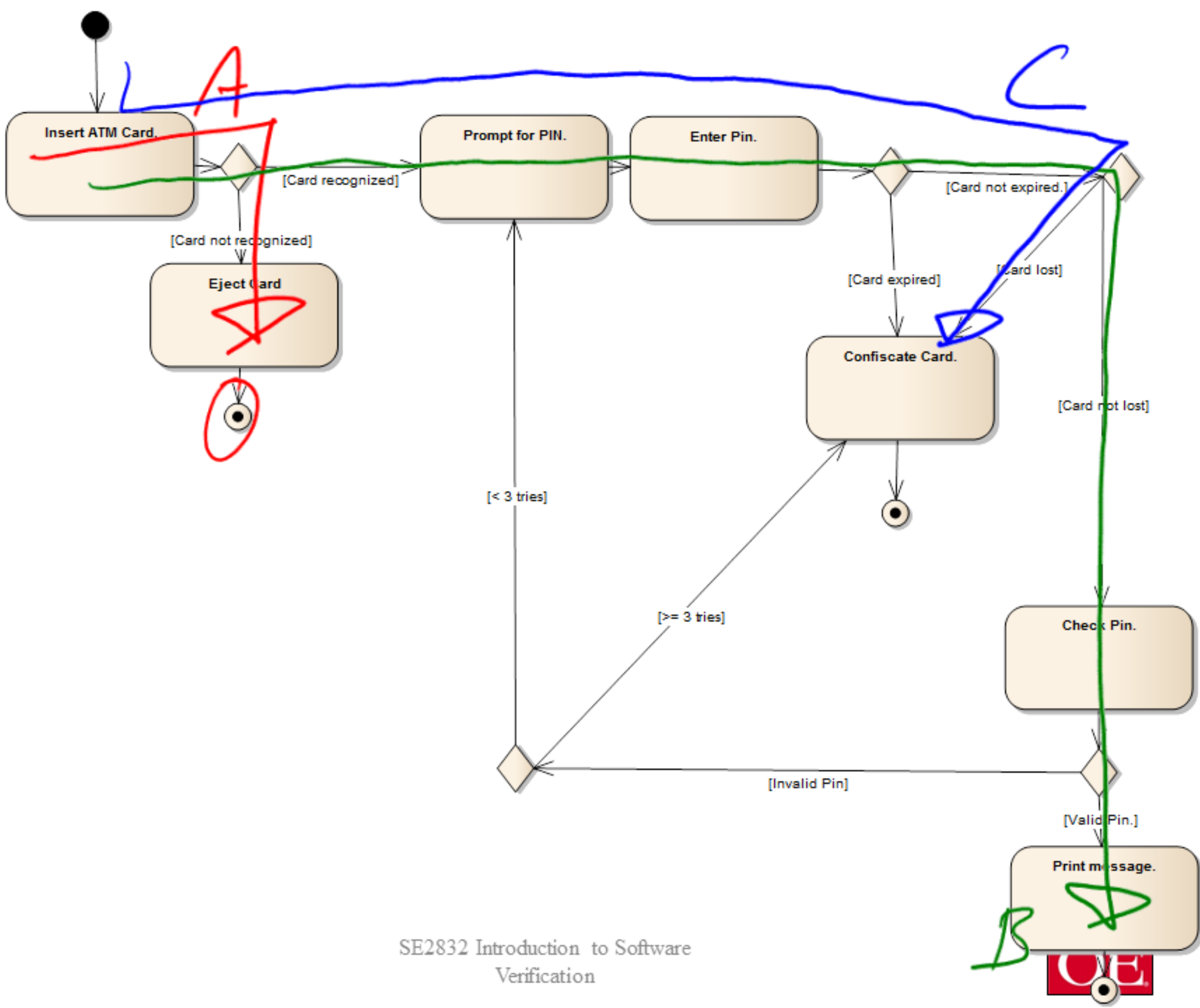
A graph from the activity diagram



- Node coverage
 - 3 tests...

A → 1 2
B → 1 3 4 6 7
C → 1 3 4 5

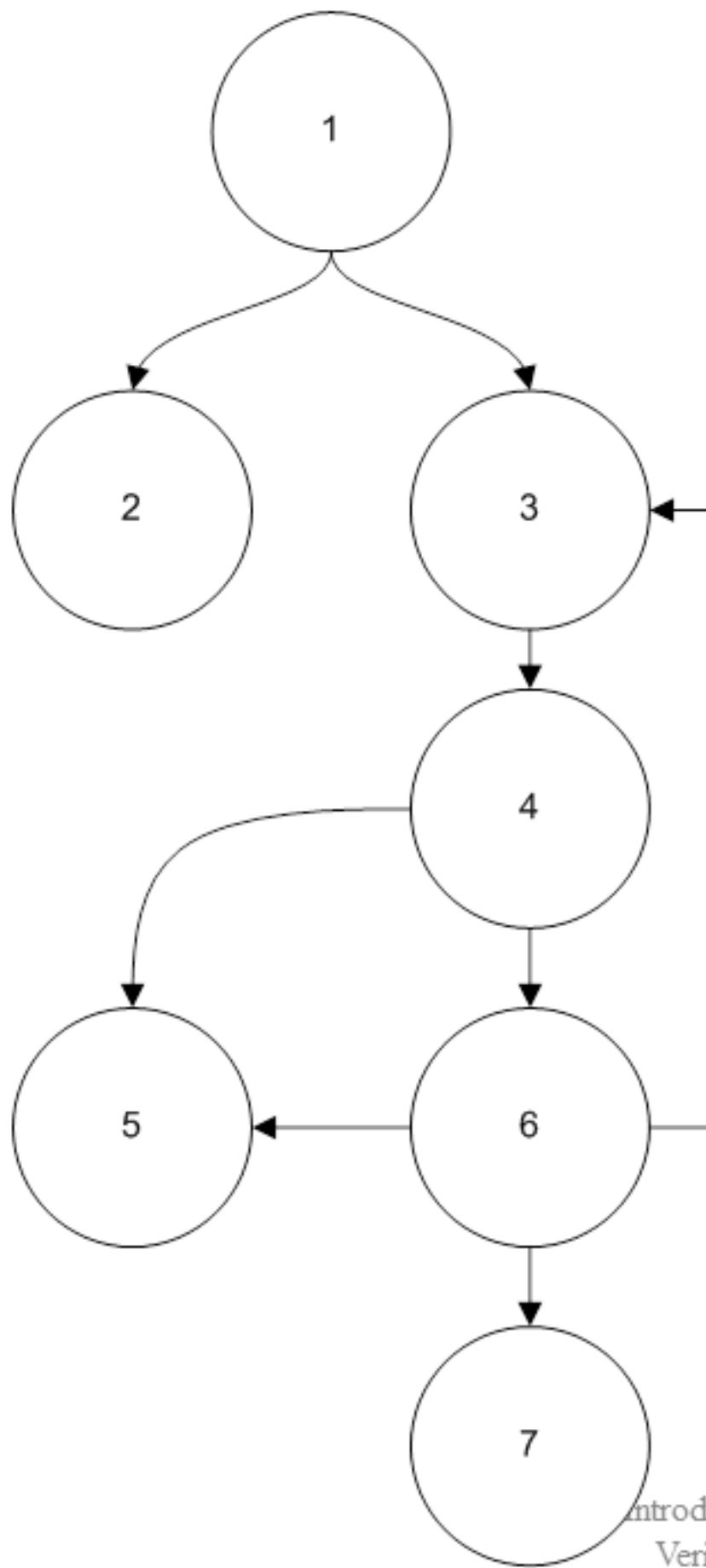
Node coverage testing



Test	initial conditions	Action	E. Result.
A	User has invalid card.	User Attempts to insert card.	Card is rejected.
B	User has valid card. User has pin of 123 where 123 is a valid pin in system card.	<div>User enters pin.</div> <div>User enters pin.</div> <div>User inserts card.</div>	User is able to access account.

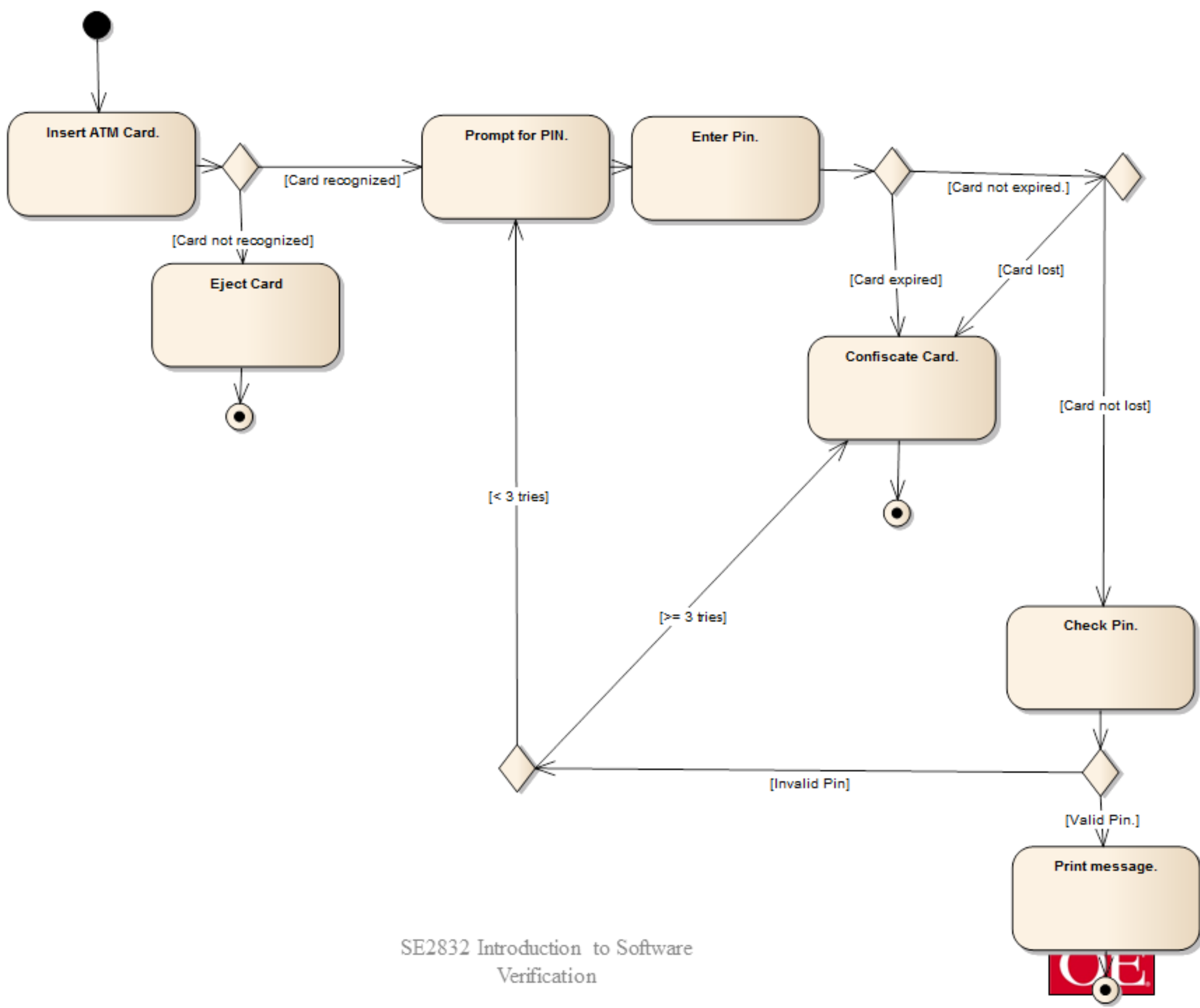
1037 B not marked as valid. card is not expired.

A graph from the activity diagram

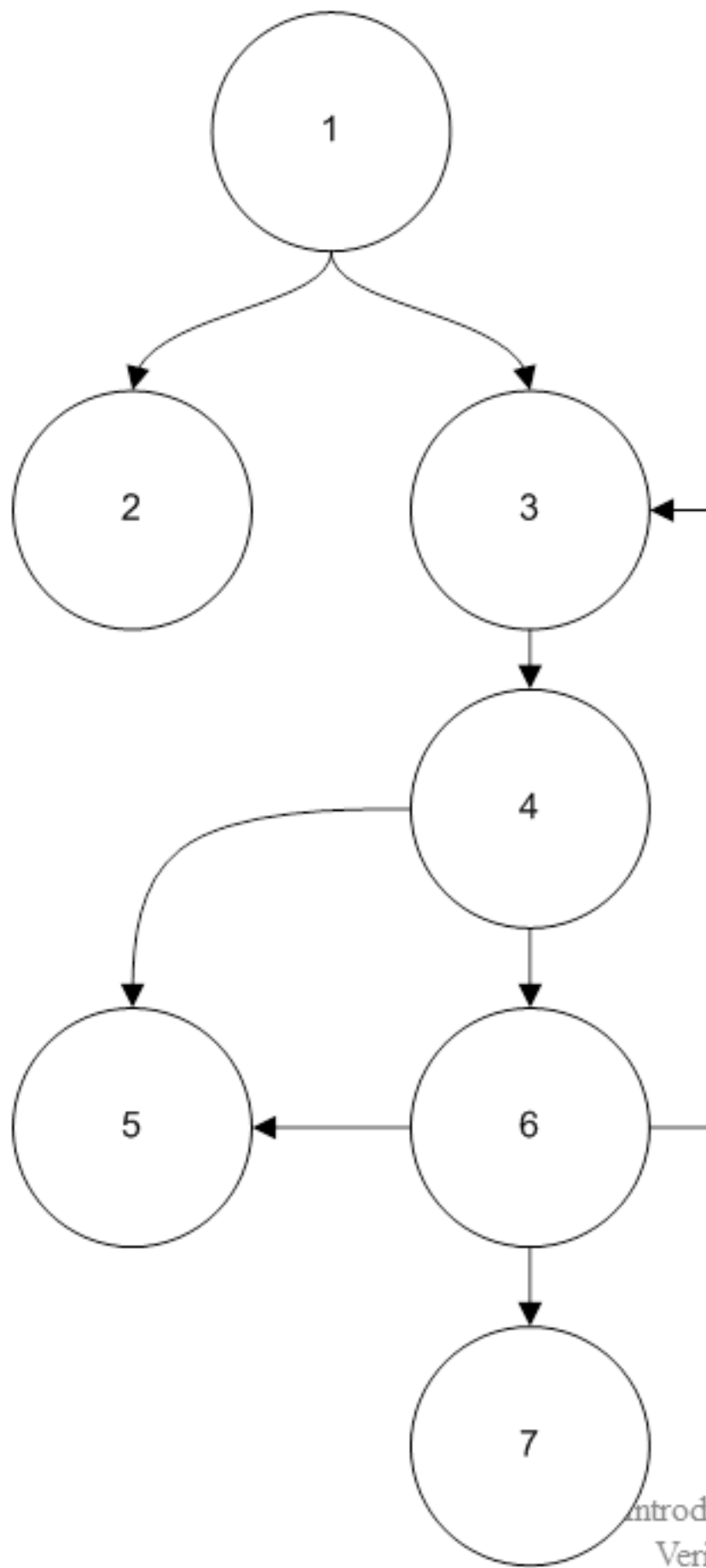


- Edge Coverage
 - 4 tests...

Edge coverage testing



A graph from the activity diagram



- Edge Pair Coverage
 - ? tests...

Edge coverage testing

