



# 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.

! New

# Use Cases and Use case

## Diagrams

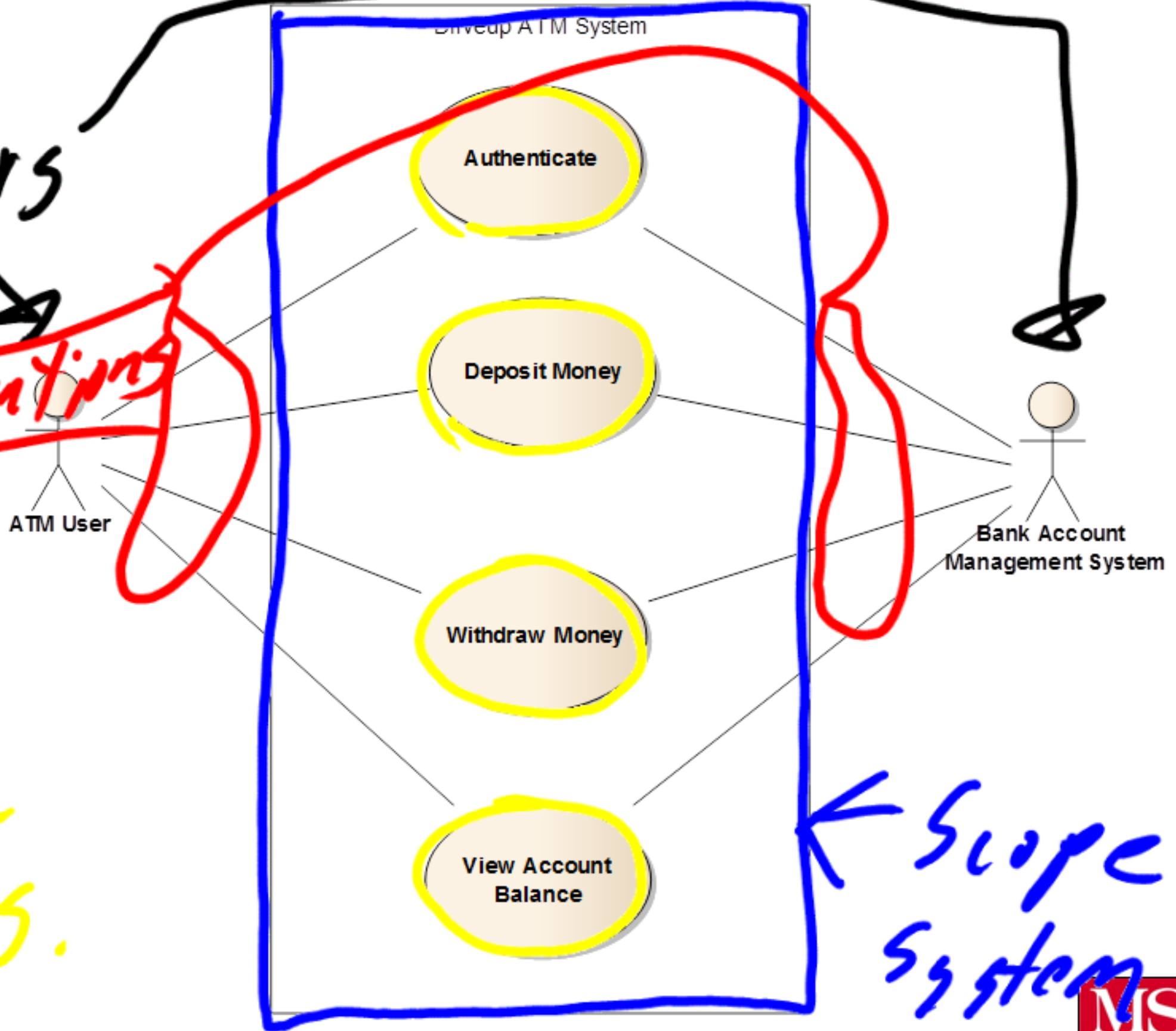
- Use Case
  - A named capability of a structural entity within a system *Something the system can do.*
  - Explanation of how someone would use the system or a capability of the system *Approaching scenario*
- Use Case Diagram
  - A diagram showing use cases and the relationship with Actors
  - Actor
    - An external entity which interacts with the system

Actors

Show associations

Use Cases

Use Cases.



# Elaboration

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

Alternate/Exception flows.

# 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.
  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.

# 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:

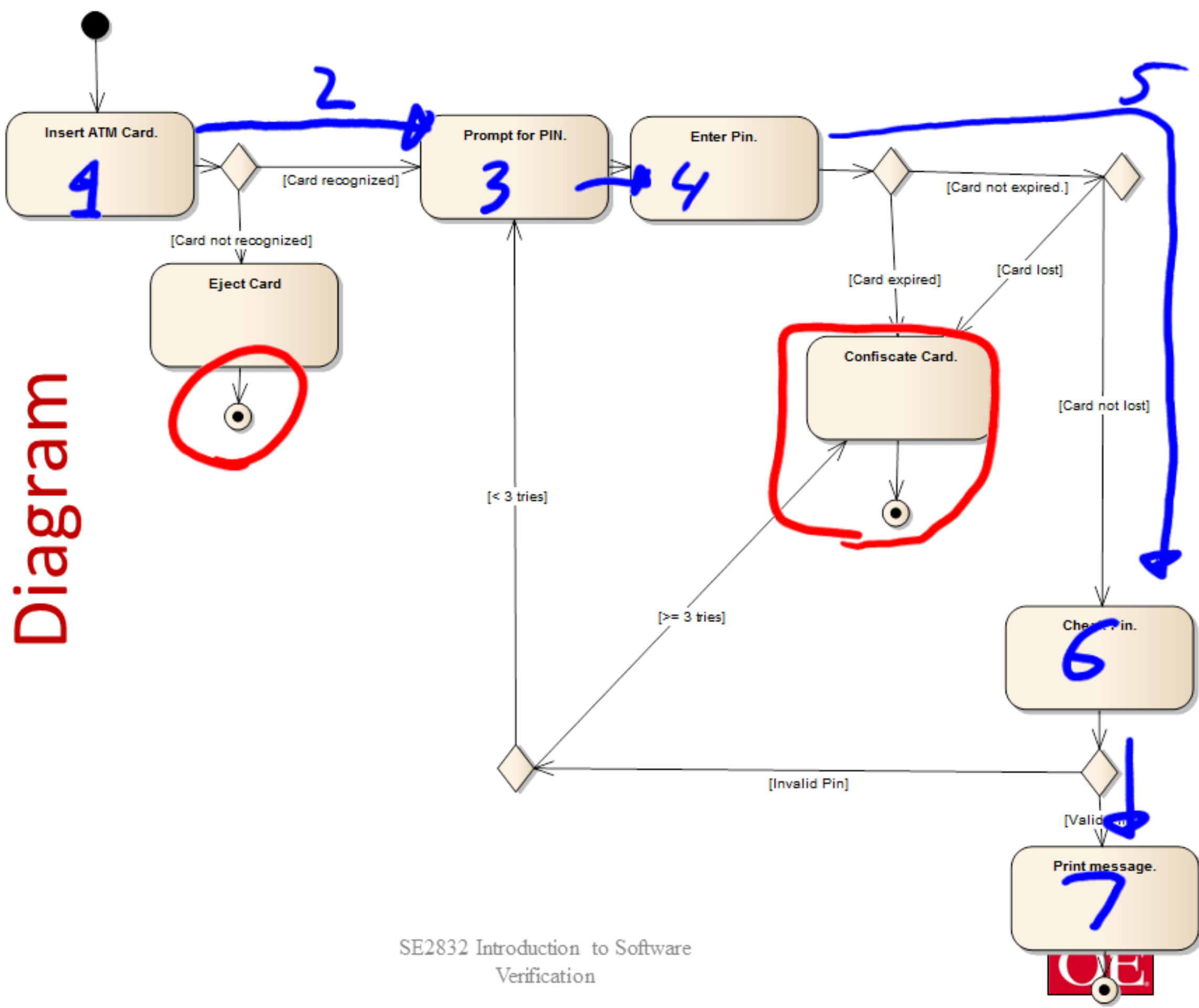
- User is allowed to access the system.

# Use Cases to Activity Diagrams

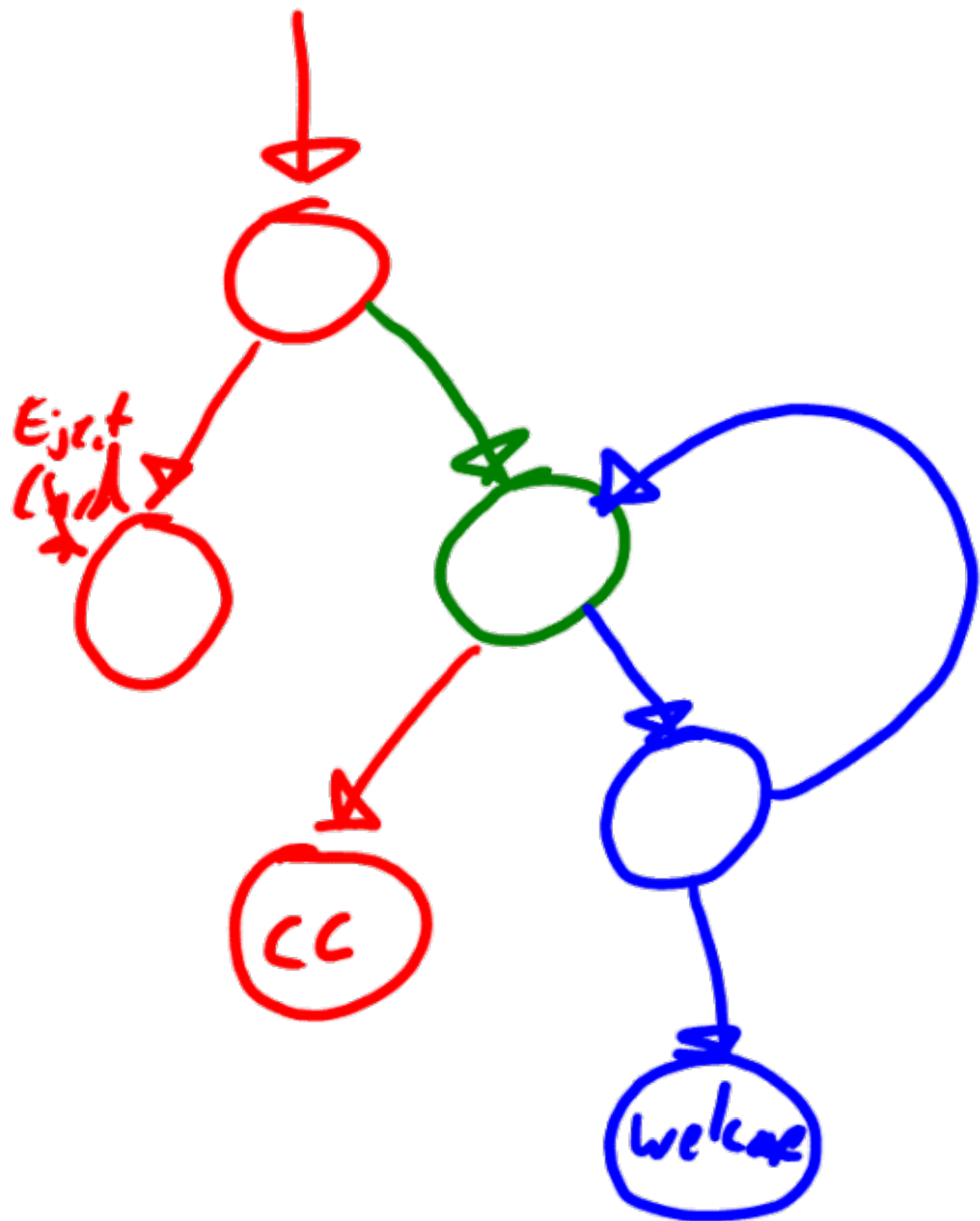
- Activity diagrams indicate flow among activities
  - Activities should model user level steps
  - Two kinds of nodes:
    - Action states
    - Sequential branches
  - Use case descriptions become action state nodes in the activity diagram
    - Alternatives are sequential branch nodes
    - Flow among steps are edges
- Handwritten notes:*  
- Decisions (circled)  
- Things user/system do. (with arrow pointing to the list)

# Authenticate Activity

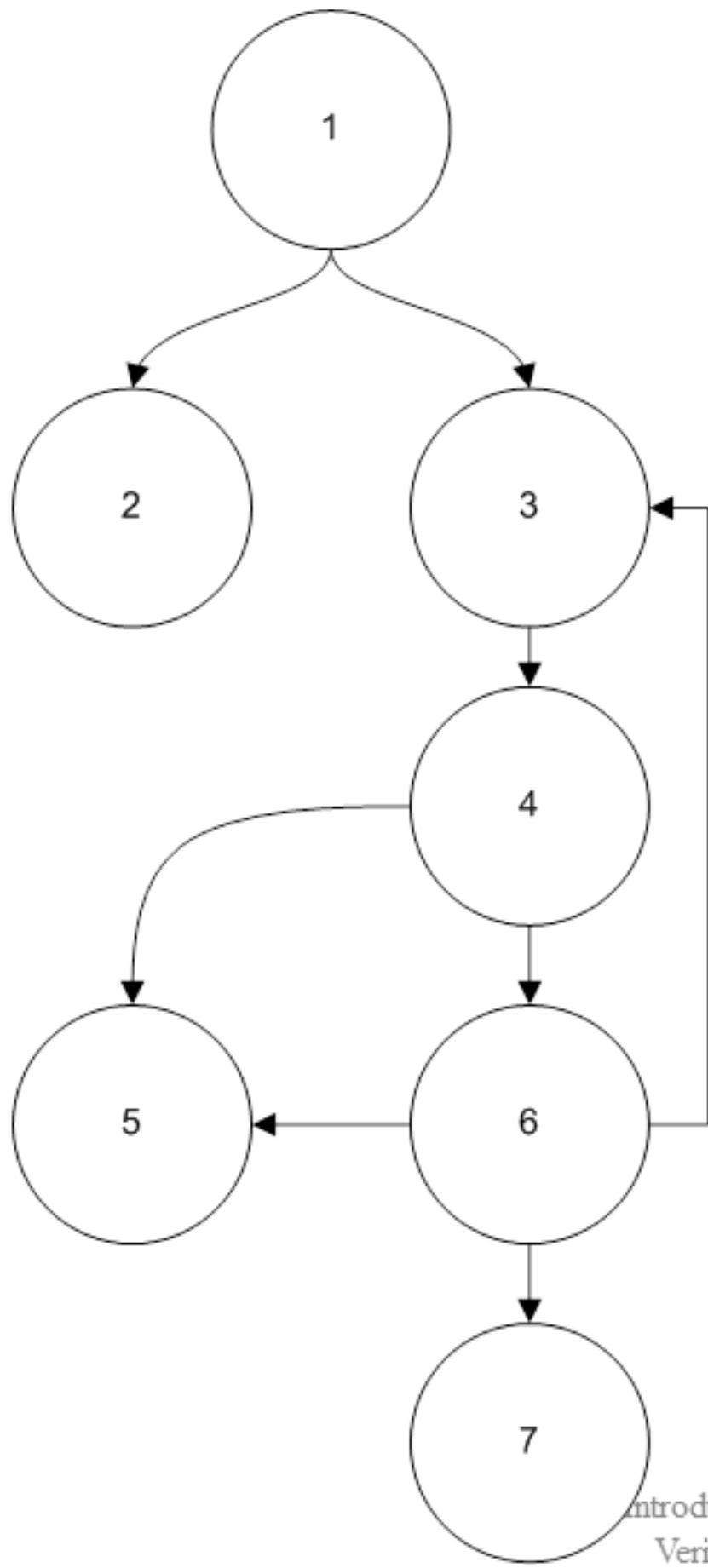
## Diagram







# A graph from the activity diagram



Edge Coverage

• Make  
sure all

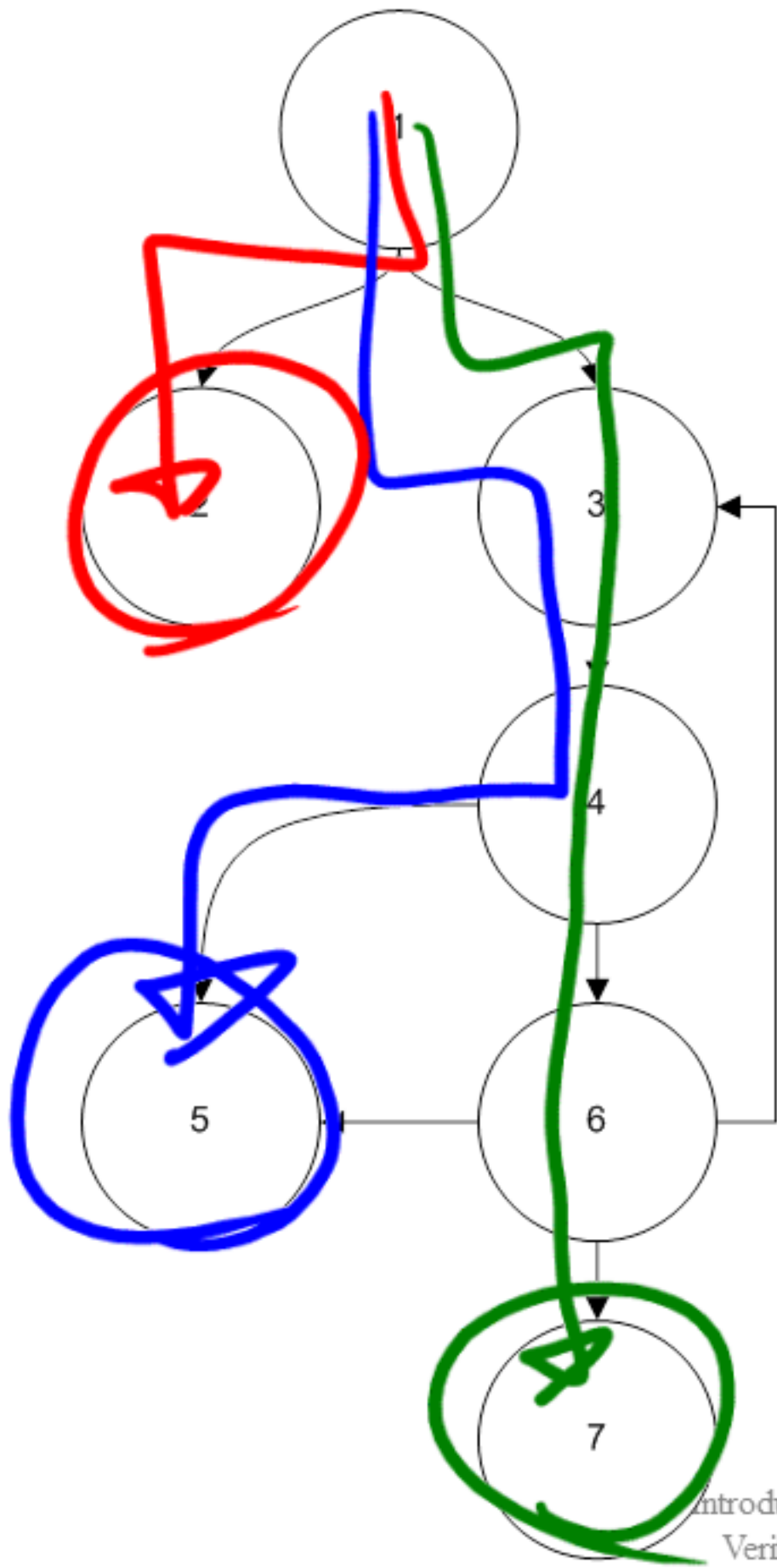
edges

happen...

# Covering Activity Graphs

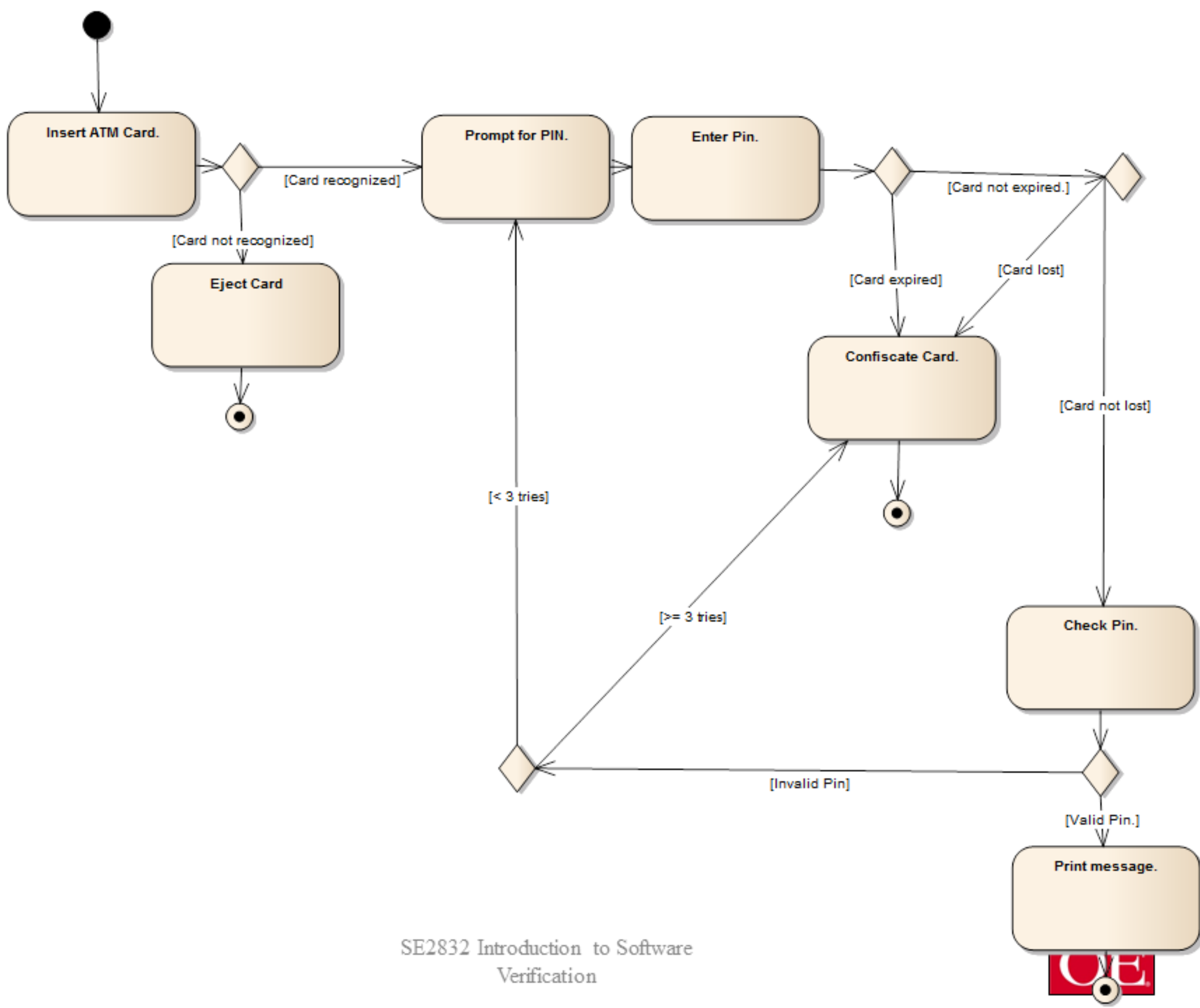
- Node Coverage
  - Inputs to the software are derived from labels on nodes and predicates
  - Used to from test case values
- Edge Coverage
- Scenario Testing
  - Scenario : A complete path through a use case activity graph
  - Should make semantic sense to the users
  - Number of paths often finite
  - If not, scenarios defined based on domain knowledge
  - 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

# A graph from the activity diagram



- Node coverage
  - 3 tests...

# Node coverage testing



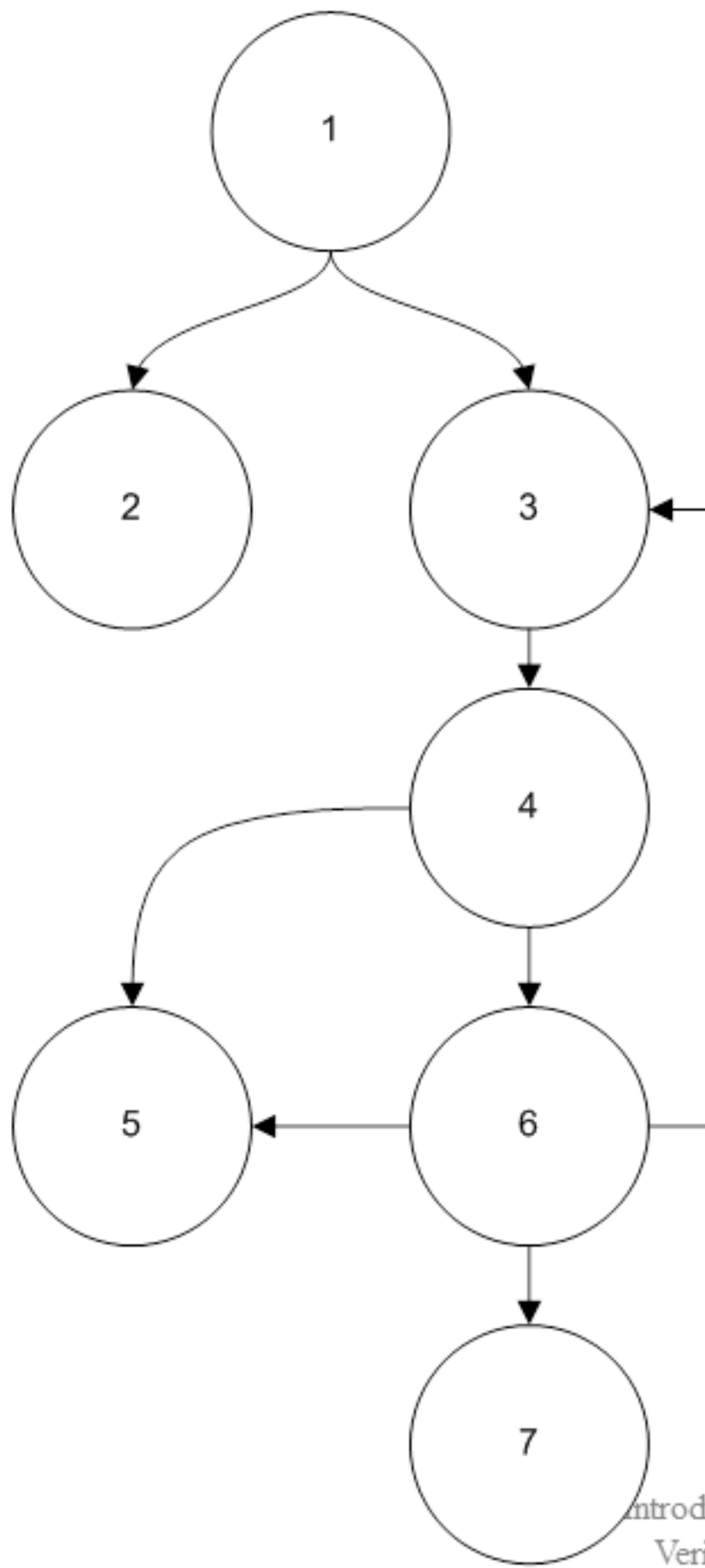
## 3 Tests:

1. User inserts ~~invalid~~ unrecognized card.
2. User inserts expired card.  
User enters pin,  
Card confiscated.

3<sup>rd</sup> Test:

1. User ~~enters~~ inserts valid card.
2. User enters appropriate pin.
3. System checks pin.
4. System prints MSG.

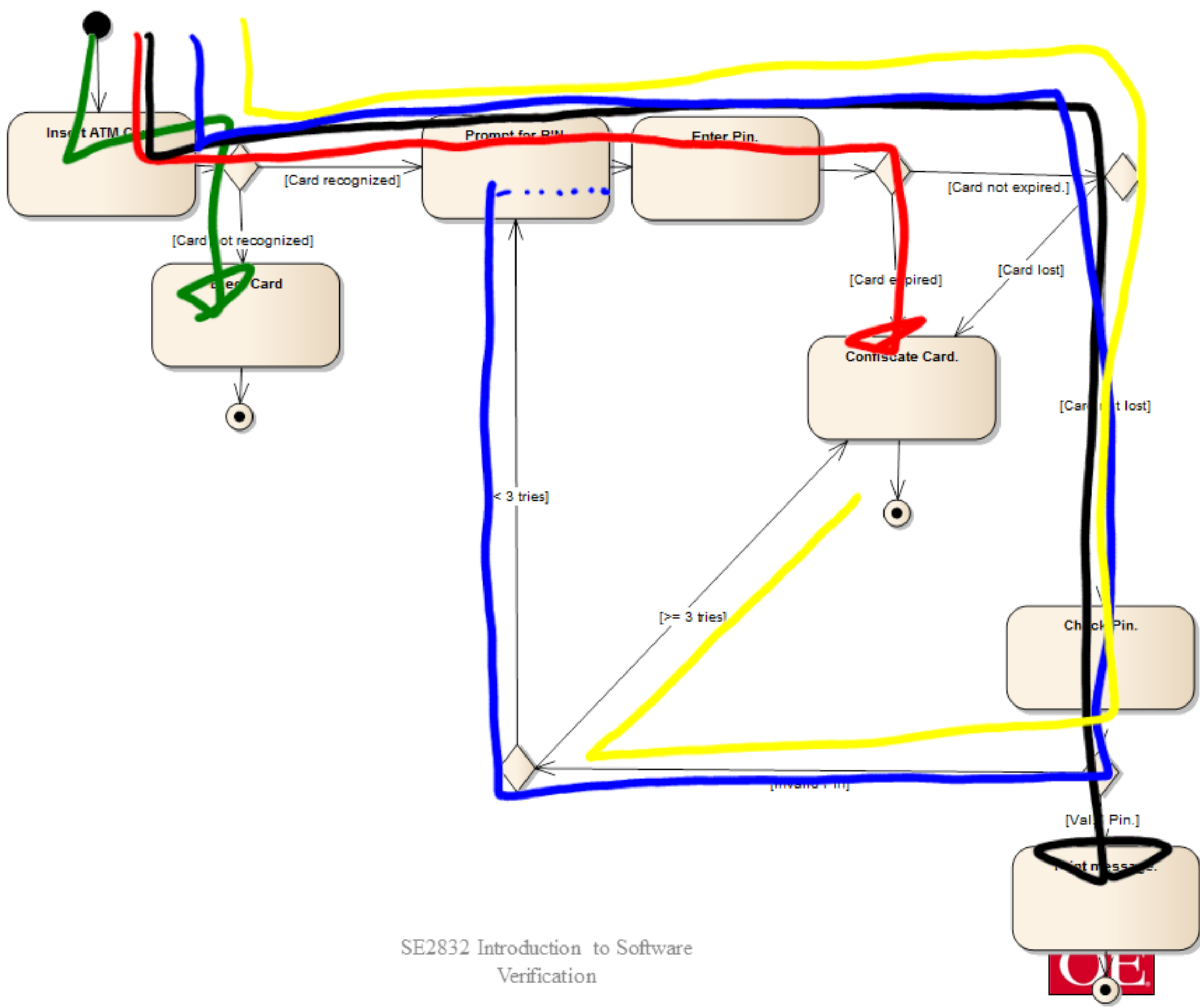
# A graph from the activity diagram



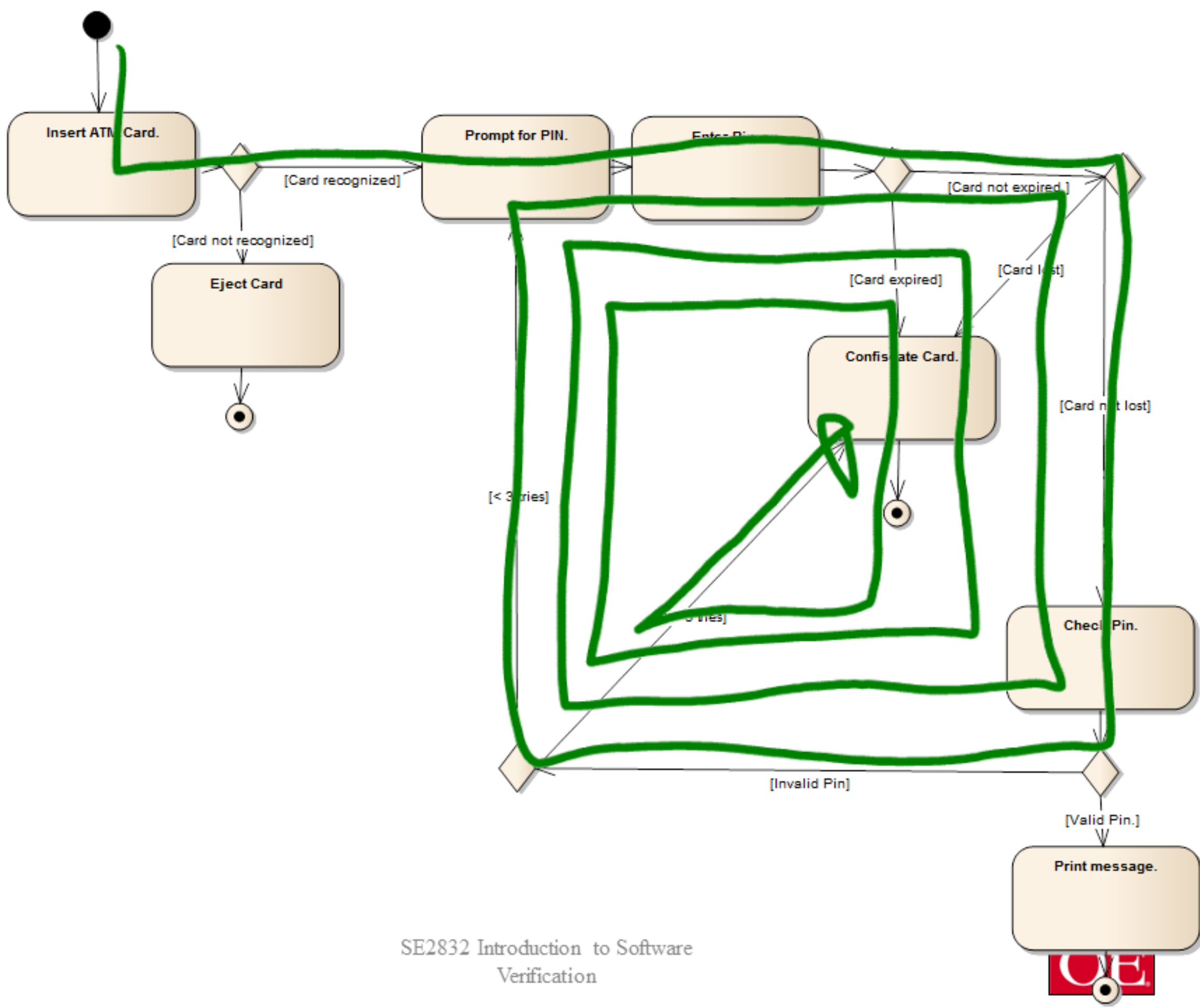
- Edge Coverage
  - 4 tests...



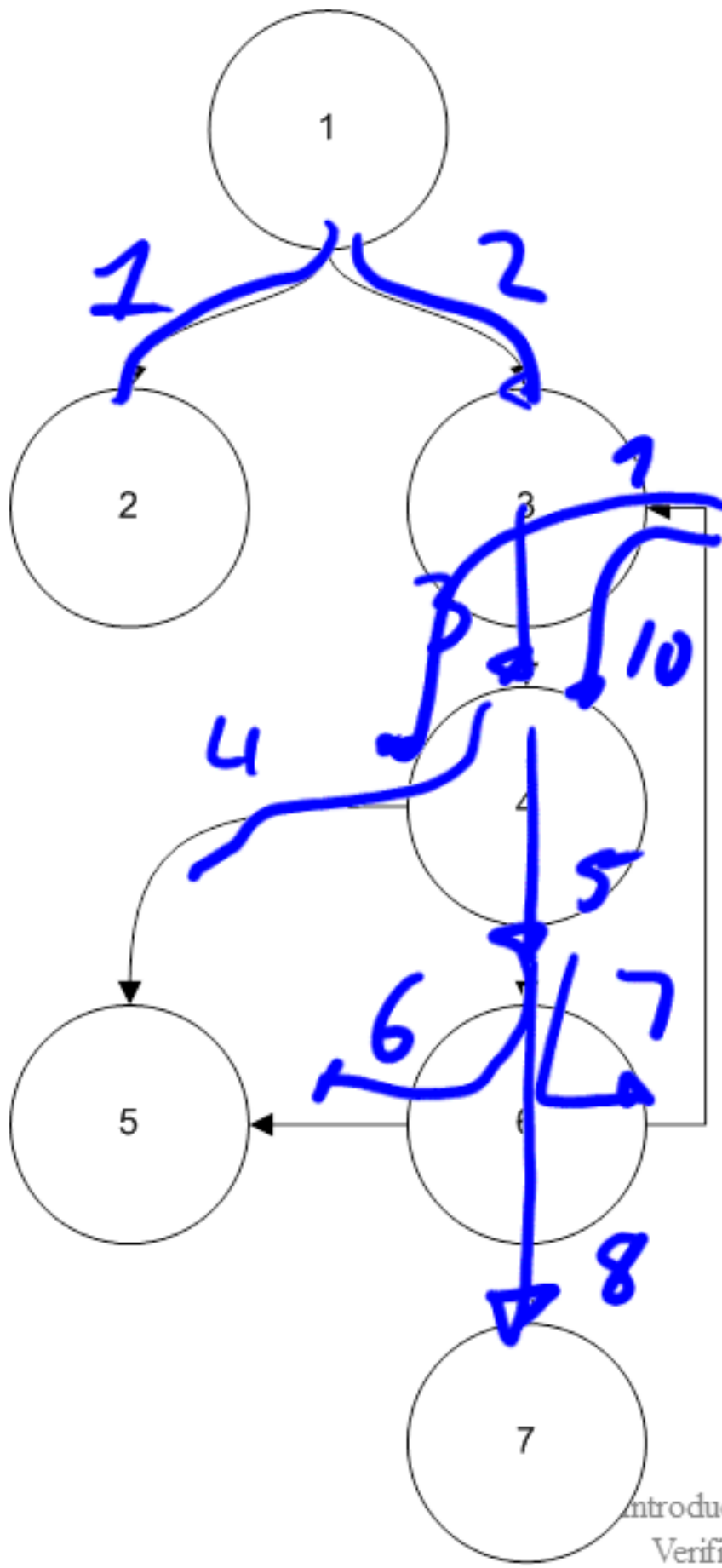
# Edge coverage testing



# Edge coverage testing



# A graph from the activity diagram



- Edge Pair Coverage
  - ? tests...

# Edge coverage testing

