Object Oriented Design and Analysis – Part 1

Learning Outcome

Using unified modeling language (UML) to model a system structure and behavior

- o Introductions to UML
- o Types of UML Diagrams
- o Creating UML Diagrams
    - Use Case Diagram
    - Activity Diagram
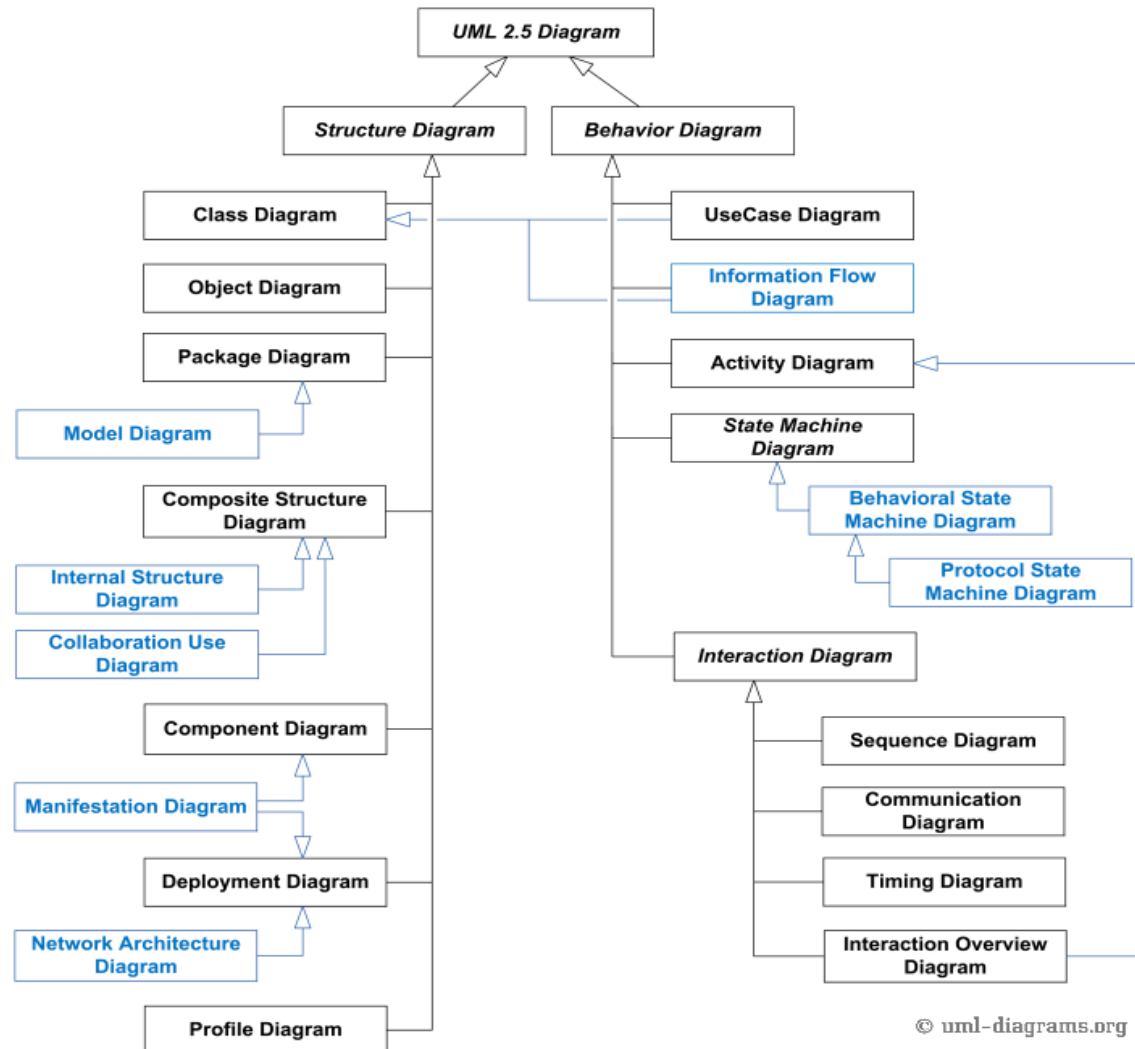   - Class Diagram

Unified Modeling Language (UML)

- Created in 1997
- Why doing UML
  - A picture worth a thousand words – Fred R. Barnard
  - Standardization of Diagrams
  - Documentation of structure and behavior of software
  - Simpler Representation
    - Classes and Objects

Types of UML

- Structural diagrams
  - o Used to describe the relation between classes
- Behavior diagrams
  - o Used to describe the interaction between people (actors) and a use case (how the actors use the system)

Types of Structural & Behavioral Diagrams

© uml-diagrams.org

Our Focus

- User stories to UML diagrams
  - o   Use Case Diagram
  - o   Activity Diagram
  - o   Sequence Diagram

What is a Use Case Diagram

- It is a graphical representation of system's functionality from the user's perspective.

- Four Components of Use Case Diagram
  - ❑Actor
  - ❑Use Case
  - ❑Relationship
  - ❑Boundary

https://www.ibm.com/docs/en/dma?topic=diagrams-uml

Use Case Diagram

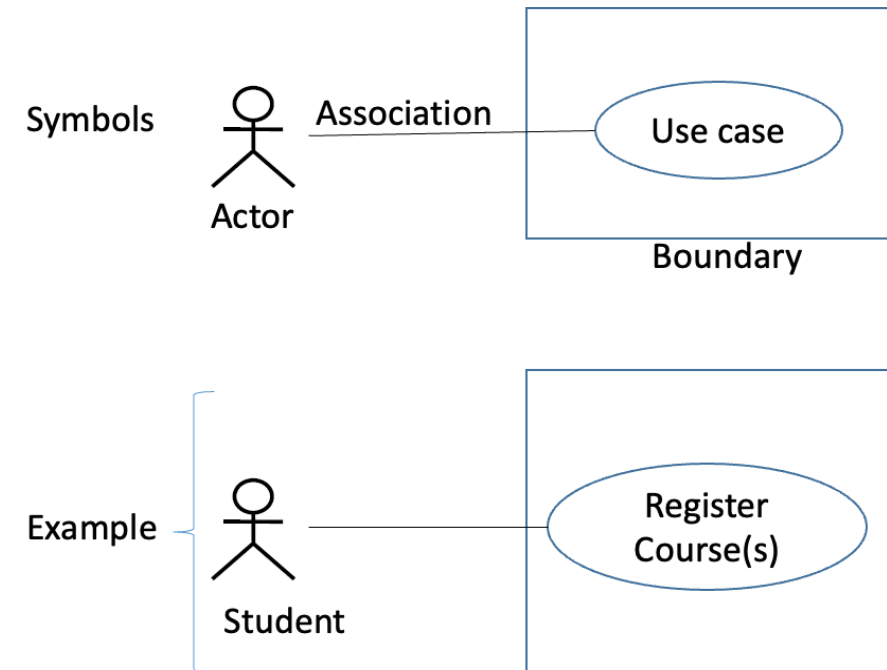## Components

Actors: The external entity interacting with a system. Entity: people, other systems, or hardware devices

Use Case: It is specification of actions(s) performed by a system which is of value to one or more actors of the system.

Association: Represents a connection (solid line) between an actor and a use case, indicating that the actor is involved in the use case.

Boundary: a rectangle that you can draw in a use-case diagram to separate the use cases that are internal to a system from the actors that are external to the system.
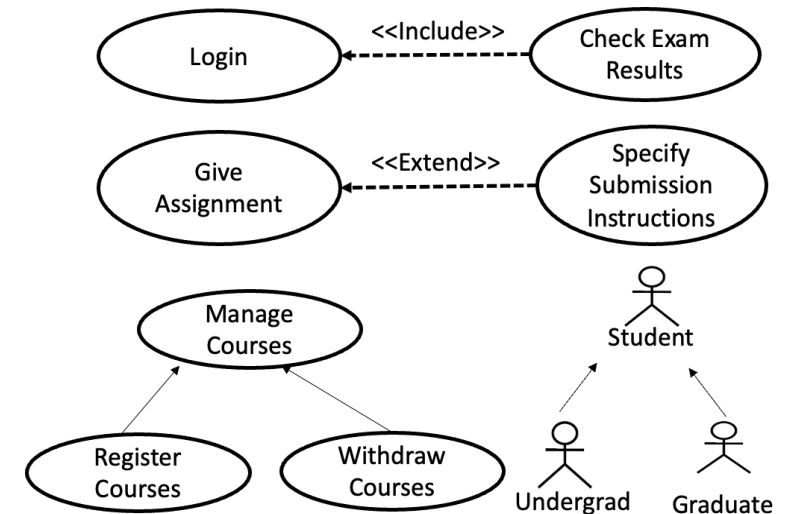
Use Case

Relationships

Include: Represents a relationship between two use cases where one use case includes the behavior of another.

Extend: Represents a relationship between a more general use case and a more specialized use case.

Generalization of use cases: Represents a relationship between a more general use case and a more specialized use case.

Generalization of actors: Represents a relationship between a more general actor and a more specialized actors.

Scenario: User Stories

❖ *As a **student**, I want to log in with my unique username and password so that I can securely access the system.*

❖ *As an undergraduate or graduate student, I want to register for courses so that I can attend classes and fulfill my academic requirements.*

❖ *As an undergraduate or graduate student, I want to withdraw from courses so that I can manage my course load effectively.*

❖ *As a student, I want to track my attendance so that I can monitor my progress and stay informed of my class participation.*

❖ *As a student, I want to check my exam results so that I can review my performance in each course.*

❖ *As a teacher, I want to assign assignments to students so that they can practice and reinforce their learning.*

❖ *As a teacher, I want to provide specific submission instructions for assignments so that students understand how to submit their work correctly.*

Red : Noun e.g., Student   Blue: Verb, e.g., withdraw

Scenario: User Stories – Remove Benefit part

❖ *User Story Syntax :* As a [user role], I want [goal/desire] so that [benefit].

❖ *As a **student**, I want to log in with my unique username and password*
❖ *As an undergraduate or graduate student, I want to register for courses*
❖ *As an undergraduate or graduate student, I want to withdraw from courses*
❖ *As a student, I want to track my attendance*
❖ *As a student, I want to check my exam results*
❖ *As a teacher, I want to assign assignments to students*
❖ *As a teacher, I want to provide specific submission instructions for assignments*
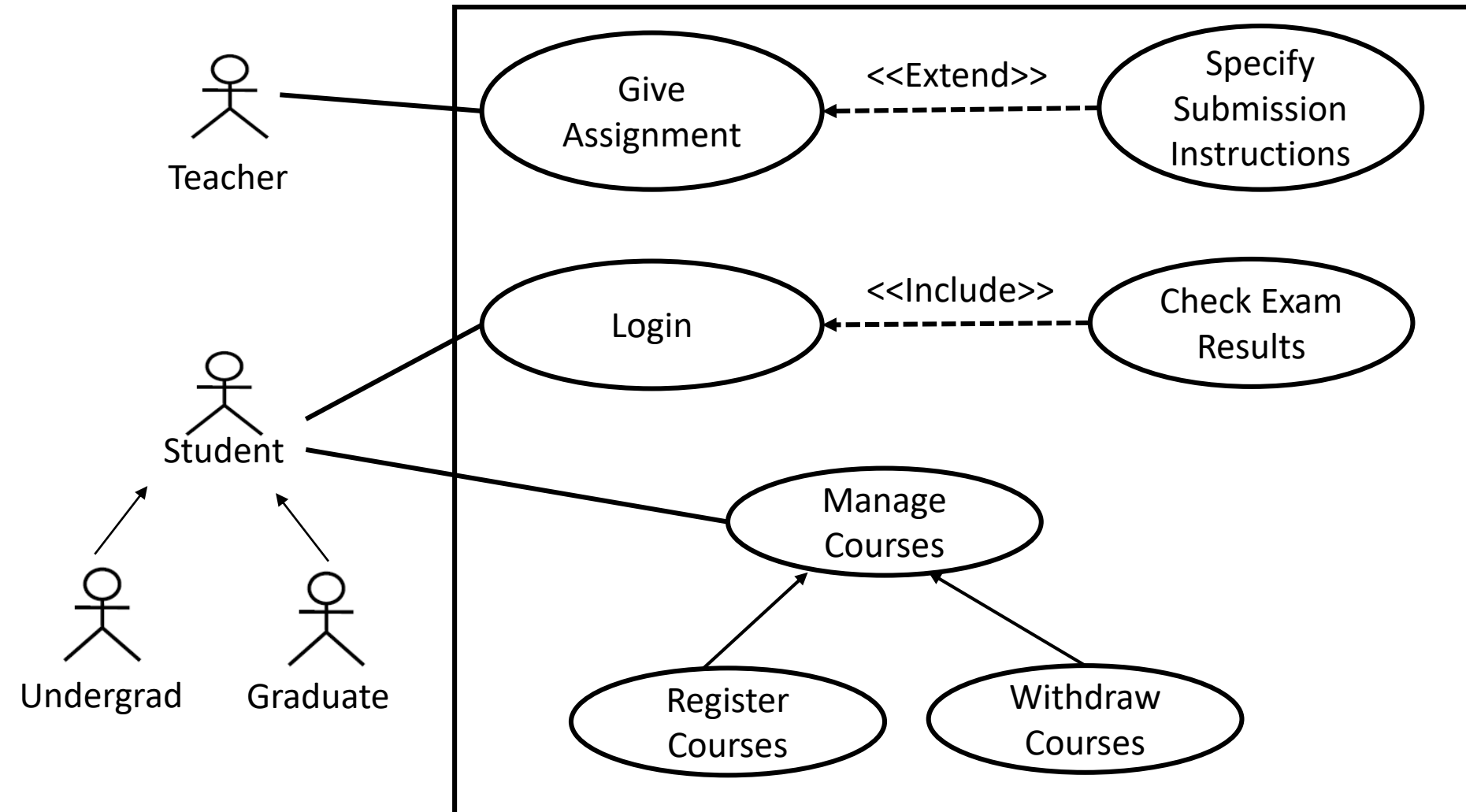
Red : Noun e.g., Student   Blue: Verb, e.g., withdraw

Steps of Creating Use Case Diagram

- Step 1
  - Identify Actors [Nouns]
  - Identify Use Cases [Verbs]
  - Identify Use Case Relationships [Actors(Nouns), Use Cases(Verbs)]
  - Identify Boundary
- Step 2
  - Draw use case diagram

Activity – Combining learned Concepts

- Goal : Creating Use Case Diagram

- Step 1:
  - Actors: Student, Teacher, Graduate Student, Under-graduate Student
  - Use Cases: Add course(s), Register course(s), Track Student Attendance, Check Exam Results, Give Assignment, specify submission instructions .
  - Relationships:
    - Check Exam result <<Include>> Login
    - Give Assignment <<Extend>> Specify Submission Instructions
    - Manage Course Generalize (Register Courses) AND (Withdraw Course)
    - Student Generalize (Undergraduate Student) AND (Graduate Student)
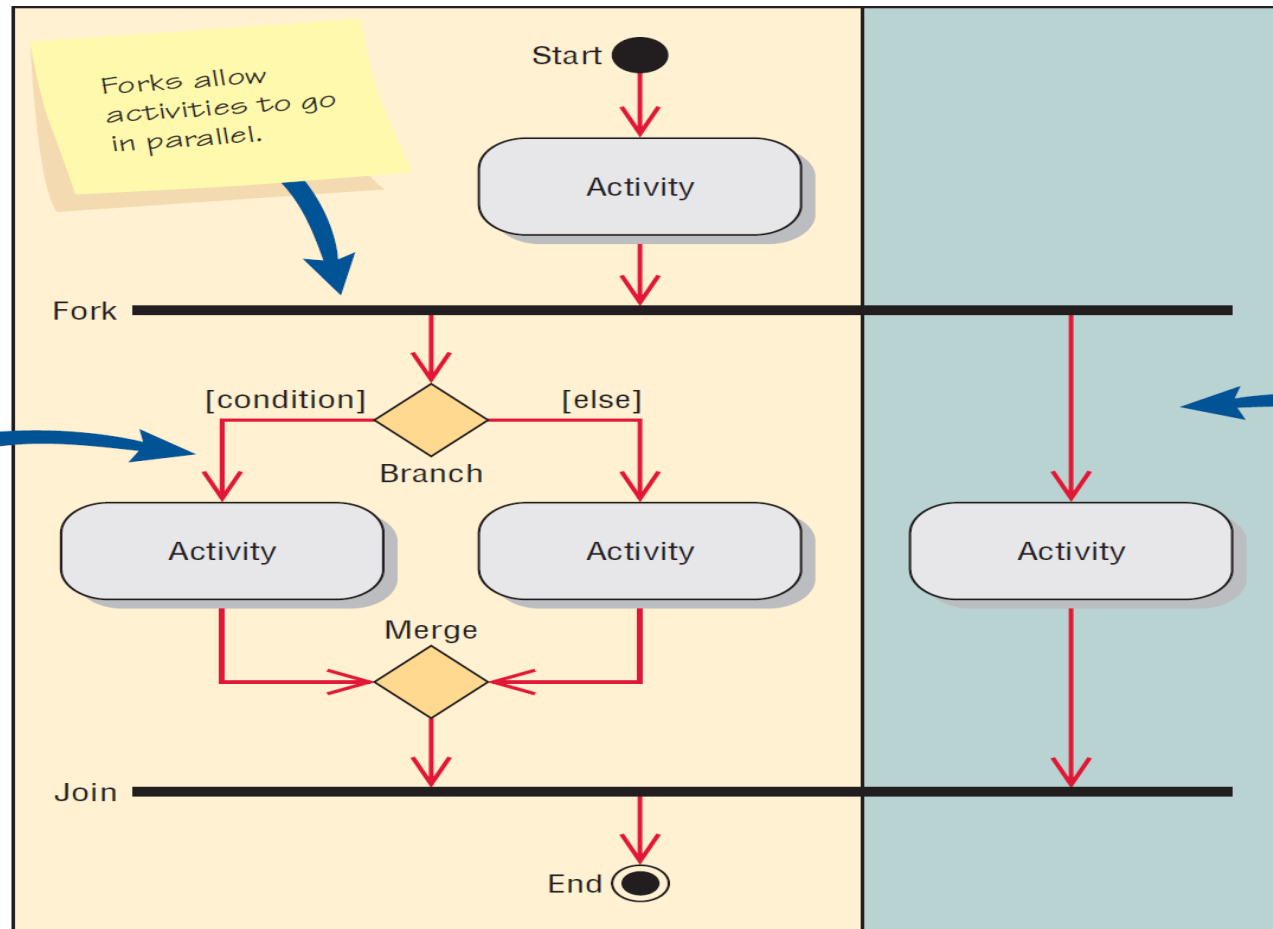 - Draw Use Case Boundary

Use Case Diagram

Activity Diagrams

- Show the sequence of activities in a process, including sequential and parallel activities, and decisions that are made
- Symbols
  - Rectangle with rounded ends
  - Arrow
  - Diamond
  - Long, flat rectangle
  - Filled-in circle
  - Black circle surrounded by a white circle
  - Swim lanes

Specialized Symbols in Activity Diagram

Creating Activity Diagrams

- Created by asking what happens first, what happens second, and so on
- Identify decisions / branches to the activity
- Determine what activities are done in sequence or in parallel
- Can be created by examining all the scenarios for a use case

Swim lanes

- Useful to show how the data must be transmitted or converted
- Help to divide up the tasks in a team
- Makes the activity diagram one that people want to use to communicate with others
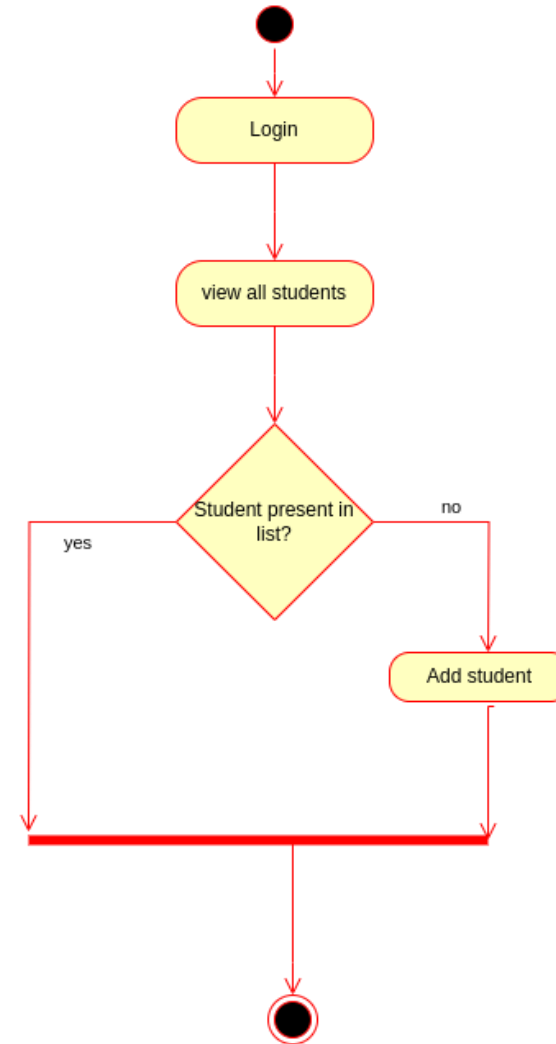
Designing the user experience (GUI)

- Use the activity diagram to capture the steps the user should take to fulfill the goals documented in the use case diagram
- You can create an activity diagram for each user story / use case
- Consider what information the user needs to have and what they need to be able to do at each step
- When you have completed your activity diagram, you can create wireframes to show the user interface required for each step
- Now you have an 'actionable' specification for you to develop
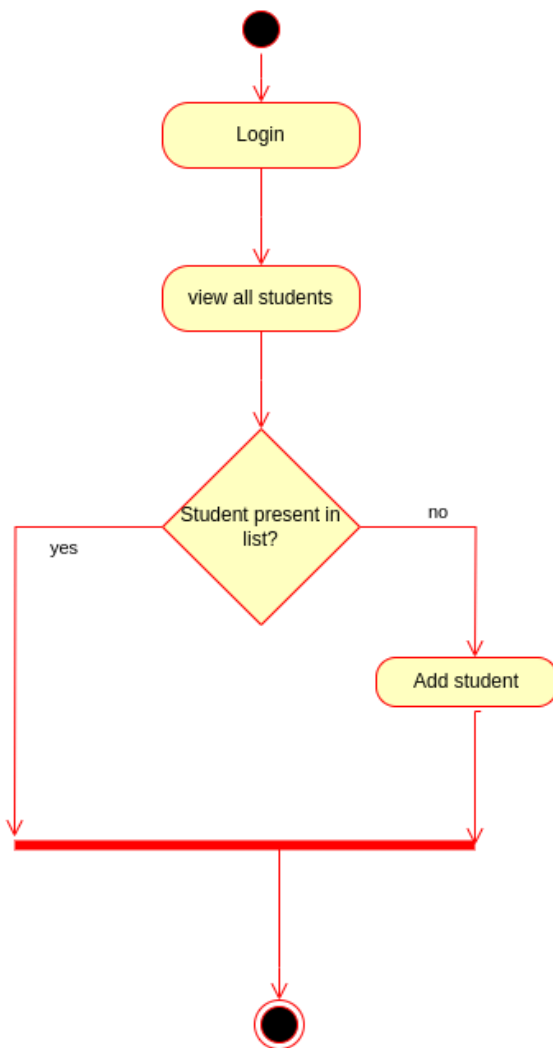
Example: User Story 1

- As an **[administrator]**, I want **[to add a new student to the system]** so that **[I can keep track of student information]**.

Example: User Story 1 – activity diagram

- As an **[administrator]**, I want **[to add a new student to the system]** so that **[I can keep track of student information]**.
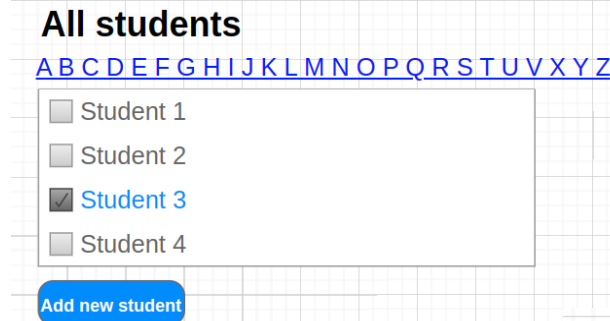
Example: User Story 2 - wireframes

Seminar task

- Create activity diagrams and wireframes for the remaining user stories:

- As a **[undergraduate student]**, I want **[to track my average grade in different subjects]** so that **[I can monitor my academic progress]**.

- As a **[graduate student]**, I want **[to upload my thesis proposal]** so that **[it can be reviewed and approved by my advisor]**.

- As a **[teacher]**, I want **[to grade student assignments]** so that **[I can provide feedback on their performance].**