Unit Revision
Object-Oriented Programming

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Learning Outcomes

- Review important topics in OOP
- Portfolio summary submission

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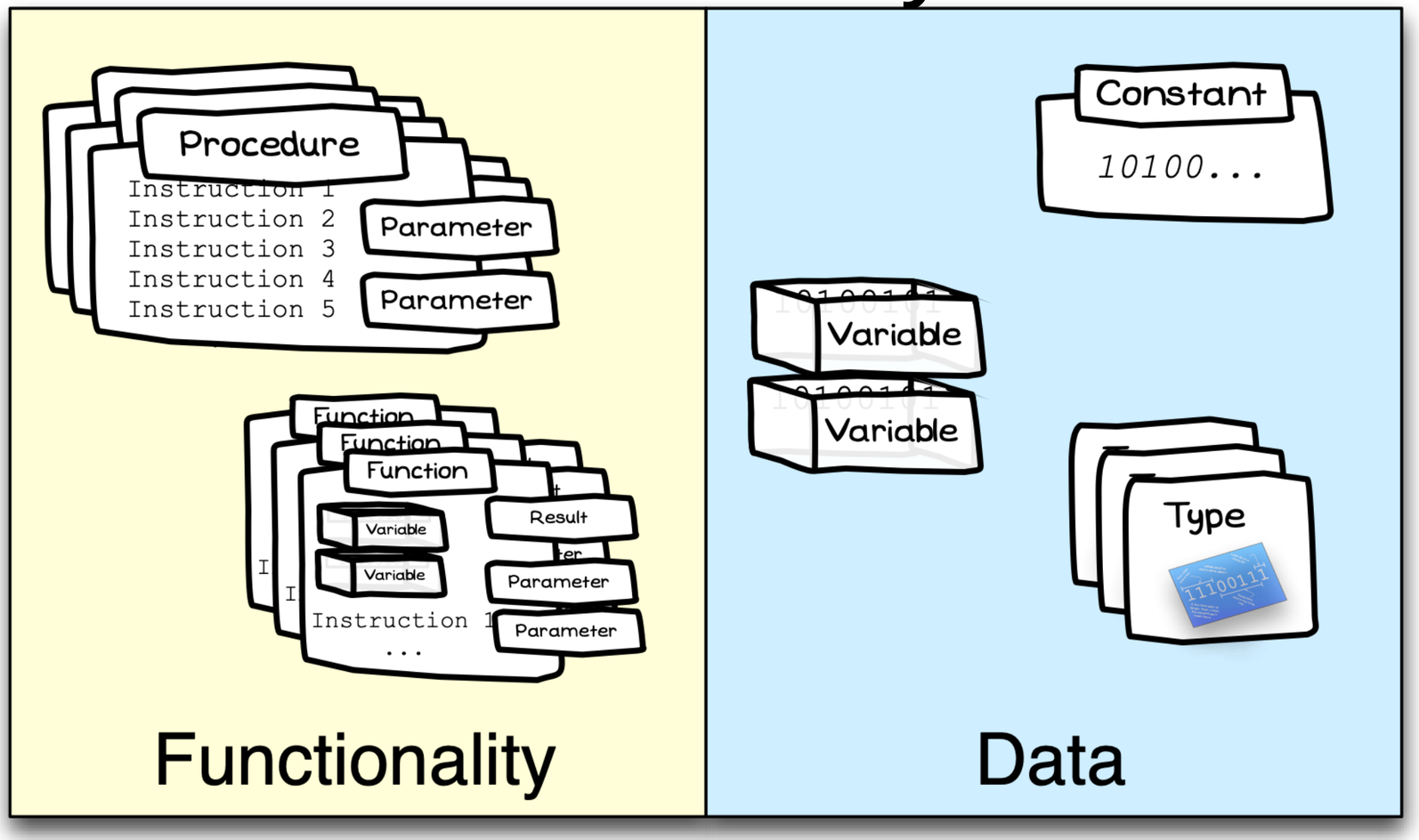
Unit Schedule

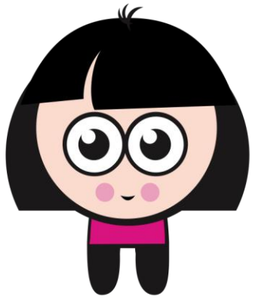
Week	Topics	Assessment	Tasks included in Portfolio
1	Introducing Objects		1.1P and 1.2P
2	Framework Classes, Unit Testing, and UML Class Diagrams		2.1P, 2.2P, 2.3P, and 2.4P
3	Collaboration, Memory, and UML Sequence Diagram		3.1P, 3.2P, and 3.3P
4	Inheritance and Polymorphism		4.1P, 4.2P,
5	Interfaces and Exceptions		5.1P and 5.2P, and 5.3C
6	Responsibility Driven Design		6.1P and 6.2P, and 6.3D and 6.4D and 6,5HD, and 6.6HD
7	Common Mistakes and Test Preparation		7.1P
8	Principles of Good Design	**Hurdle Test (48-hours)**	
9	General Responsibility Assignment Software Patterns		9.1P, and 9.2C, and 9.3HD and 9.4HD
10	Design Patterns		10.1C
11	Other Object Oriented Languages		11.1P
12	Object Oriented Programming in a Nutshell		**Portfolio Submission and Assessment**

Week 1: Program procedurally by organising code into separate artefacts for data and functionality

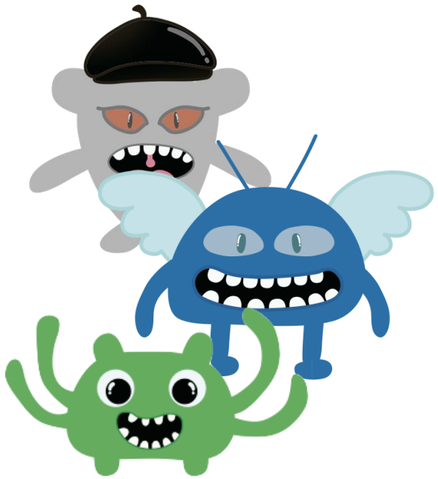


Week 1: With Objects, you create entities that encapsulate **both** functionality and data — they know and can do things

Week 1: Use abstraction to classify the different kinds of roles objects will play in your software



classify → Player



classify → Alien

Use Abstraction (Classification) to define object classes

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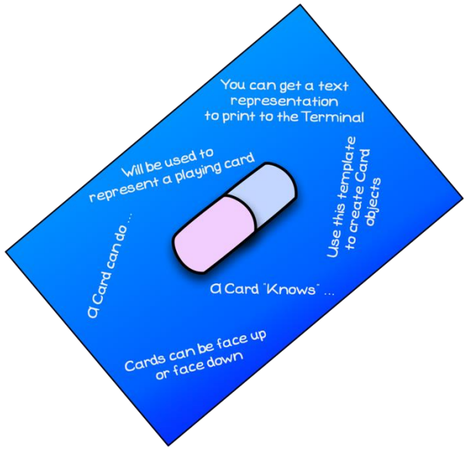
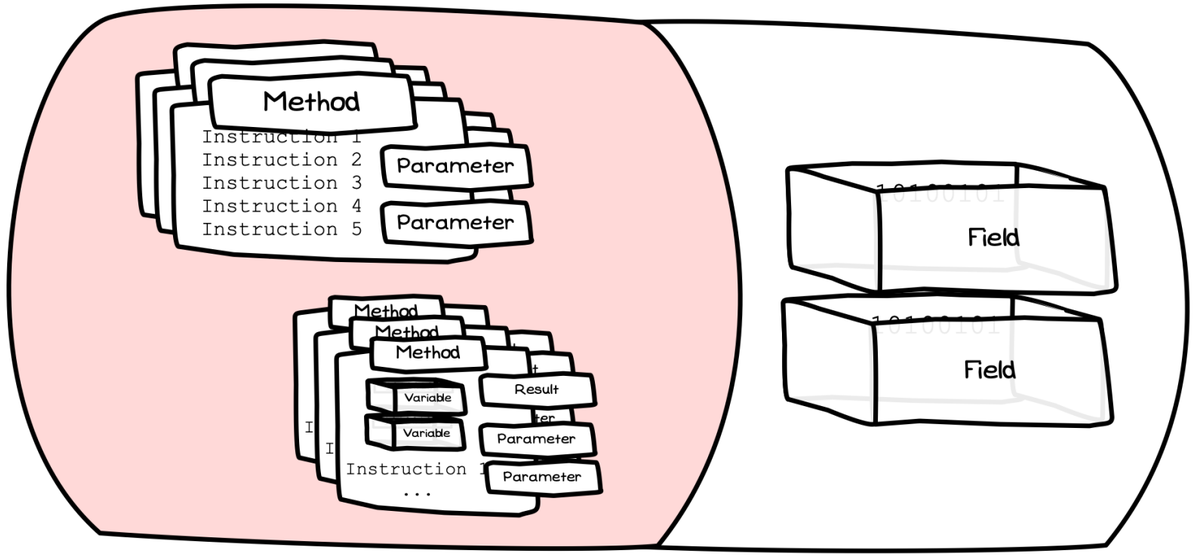
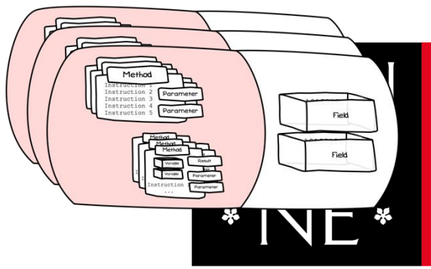
Week 2: Add special methods called constructors to initialise your objects when created





Constructors are declared within the class

These define how to create/initialise the objects.



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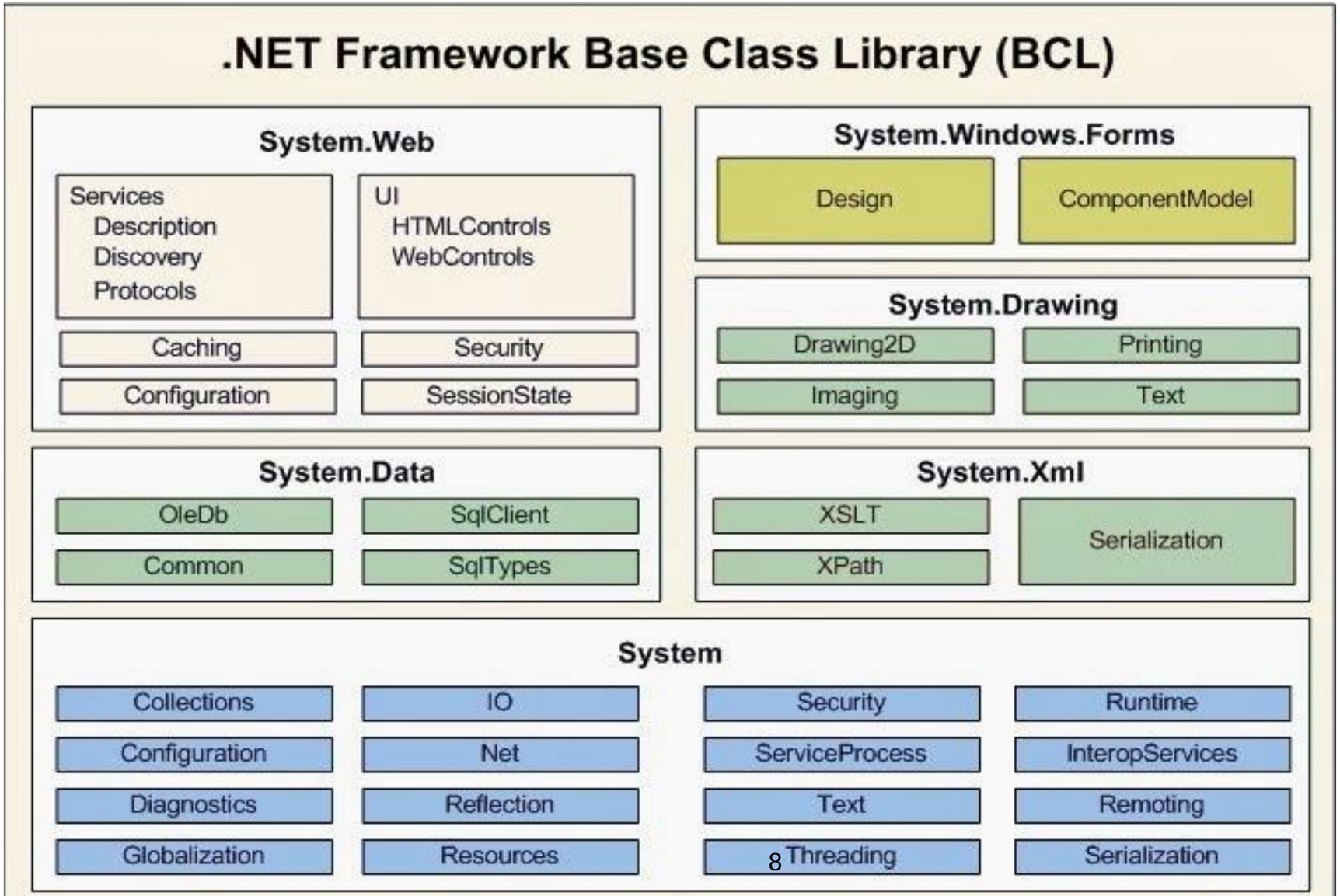
Week 2: . Net Frameworks cover an extensive range of features.



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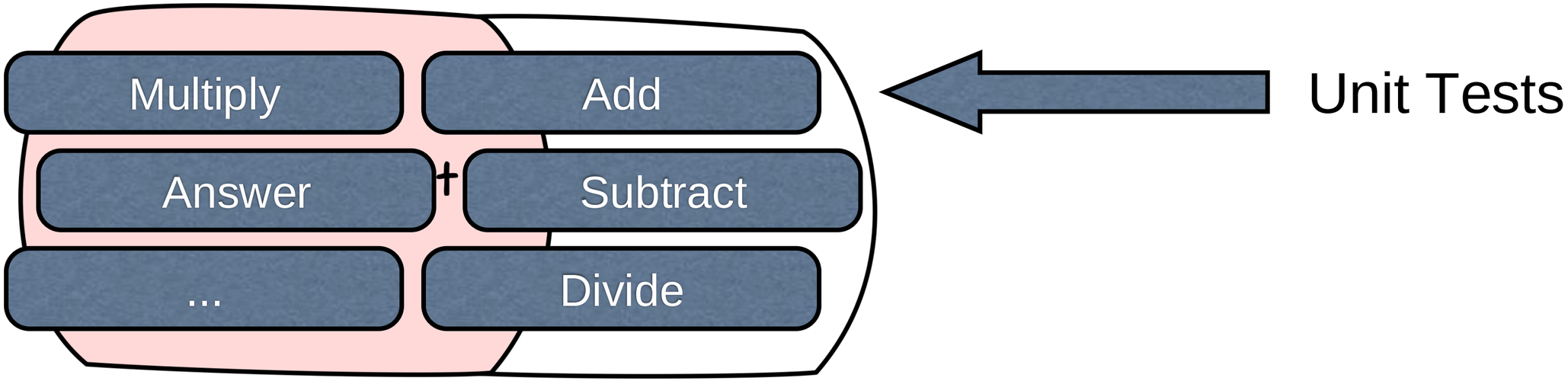
Week 2: Unit Test



Week 2: Create Testing Classes

```
namespace Task1_2
{
    public class StudentTests
    {
        [Test]
        public void StudentName_ShouldBeSetCorrectly()
        {
            // Arrange
            Student student = new Student("John Doe", 1);

            // Act
            string name = student.Name;

            // Assert
            ClassicAssert.AreEqual("John Doe", name);
        }
```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Week 3: Object collaboration

Association

Aggregation

Dependence

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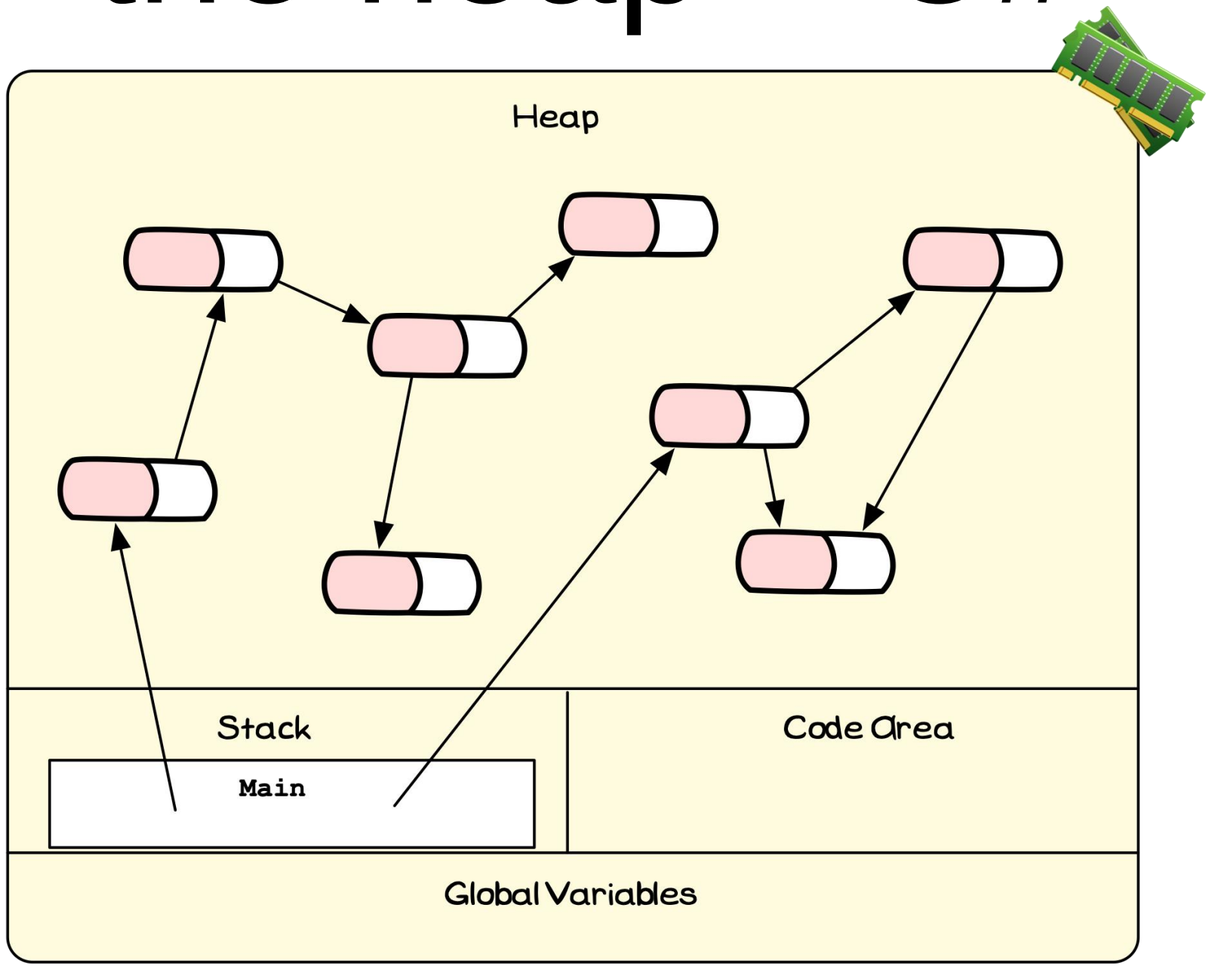
Week 3: At runtime objects exist on the heap – C#



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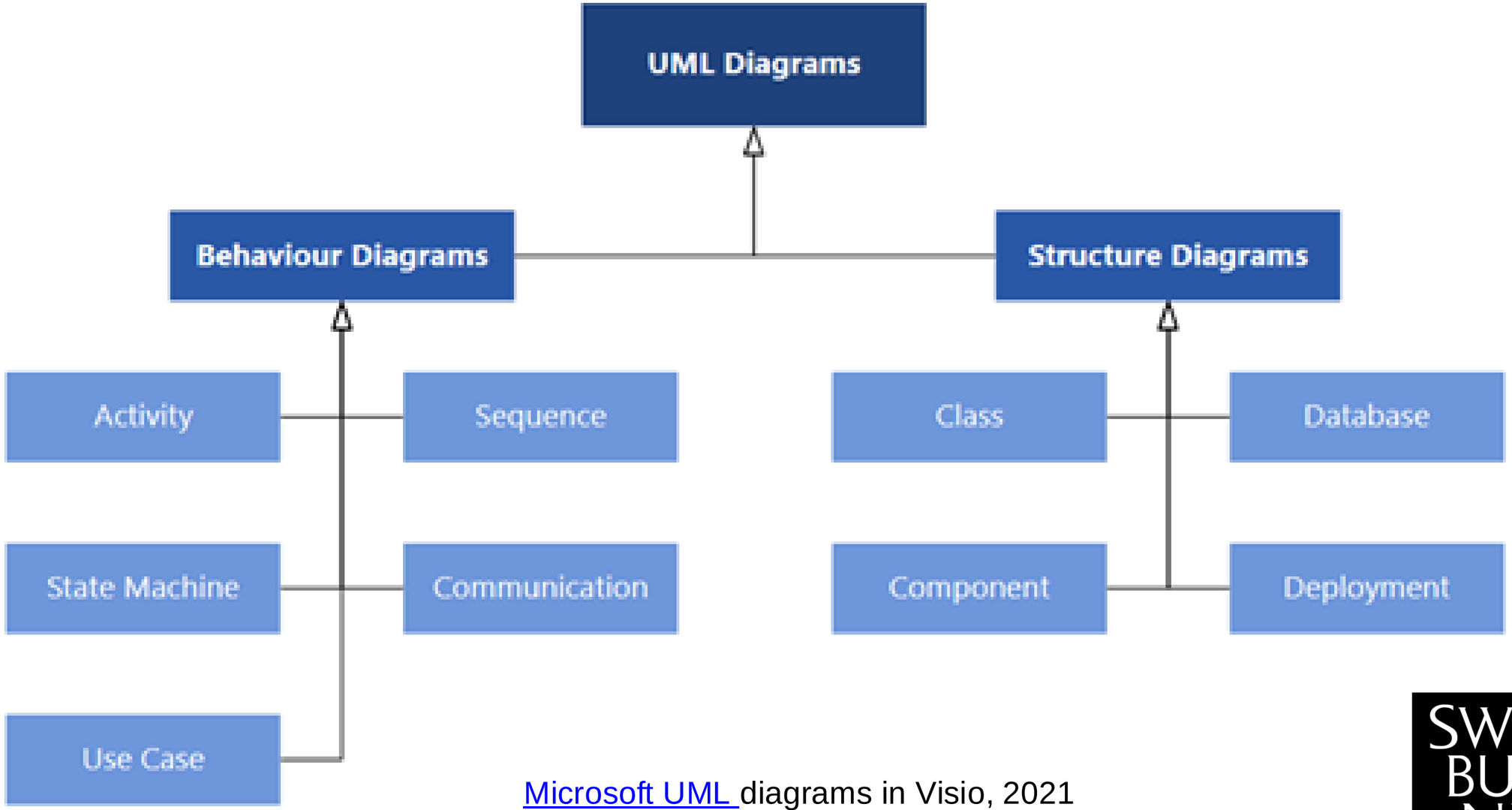
Week 3: Different Types of Diagrams



Microsoft UML diagrams in Visio, 2021

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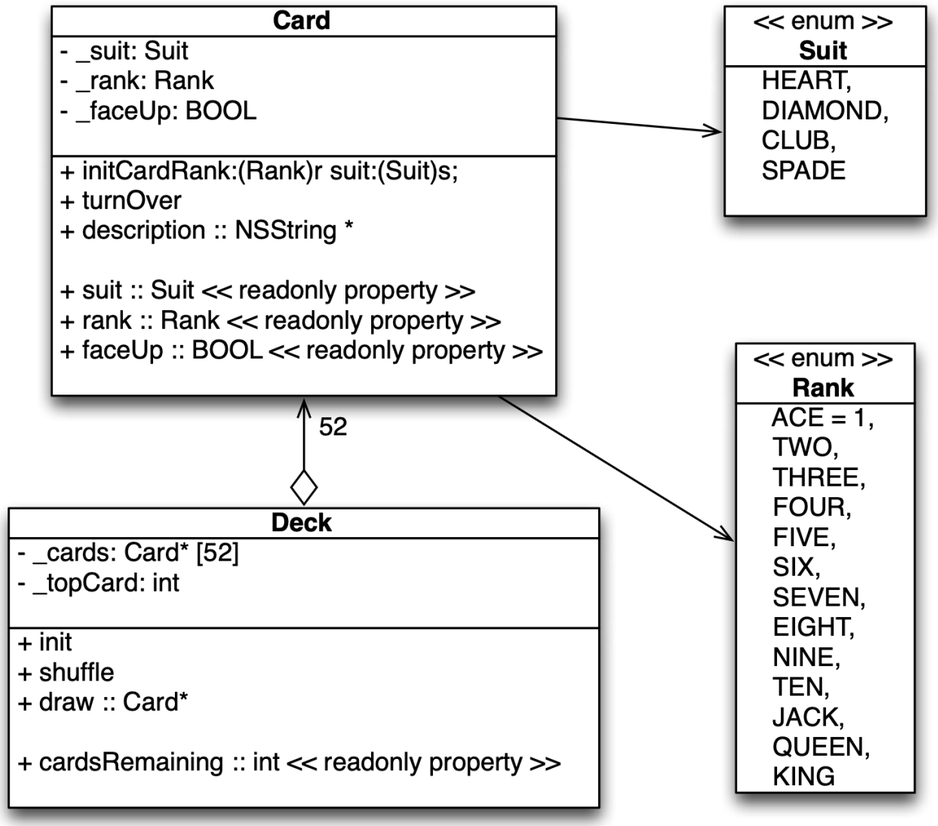
Communicate the static structure of your program using a class diagram



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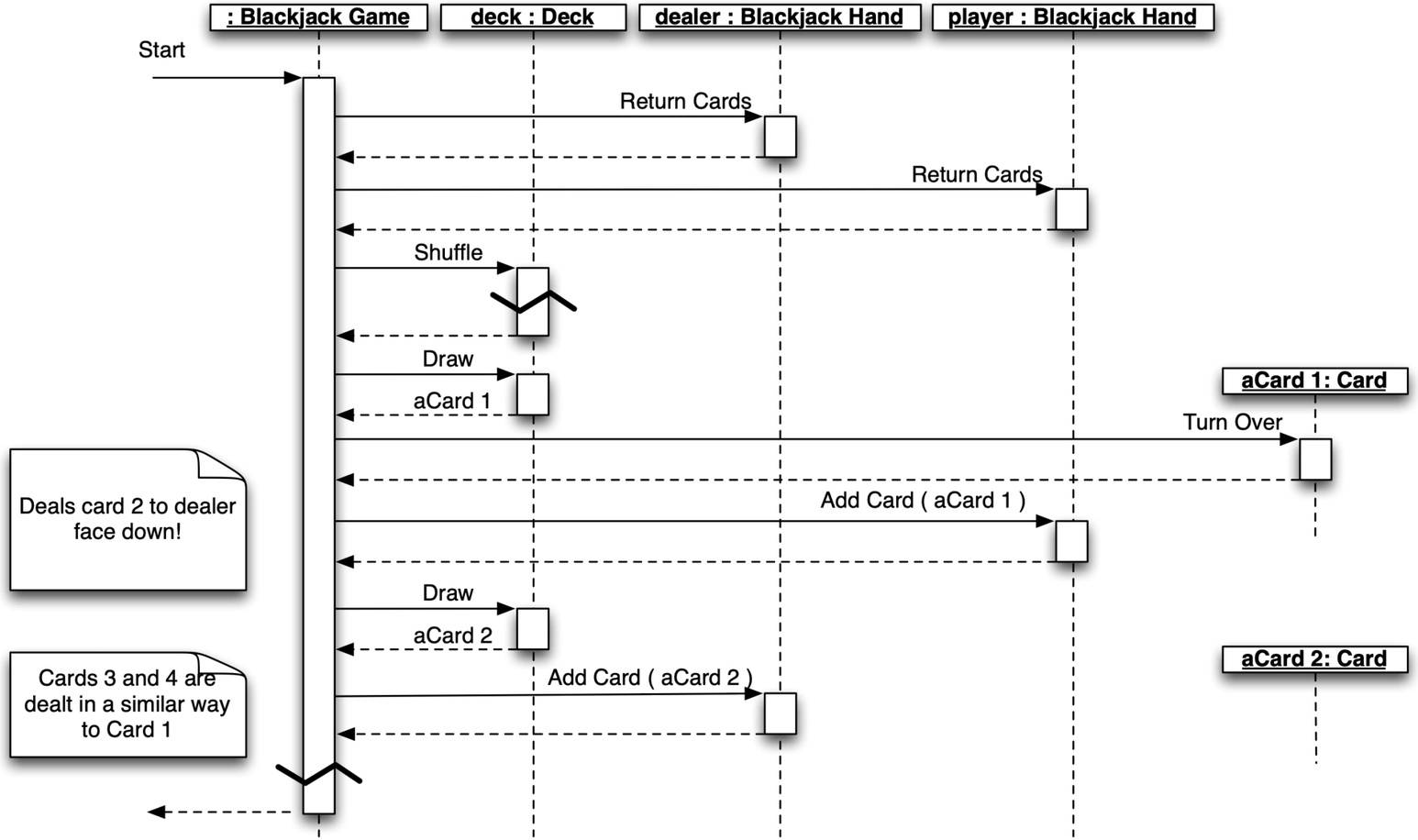
Sequence Diagram : Communicate interactions using a sequence diagram



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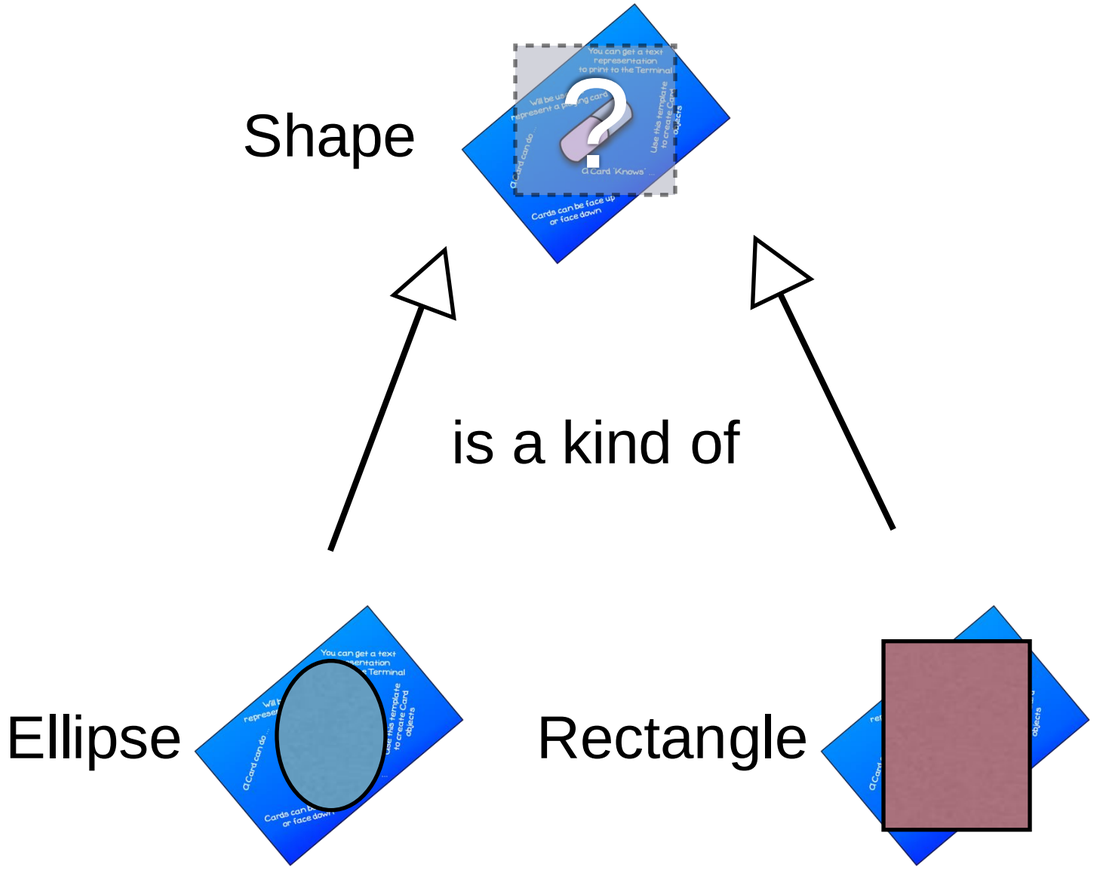
Week 4: Use inheritance to model **is-a** kinds of relationships



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Week 4: Use child objects where the parent is expected

- Polymorphism – a Greek word that means “many-shaped”
- As C# developers, we do not know which specific type of shapes the end-user may want to instantiate in runtime
- No matter which shape selected, it still has a ‘Draw’ behaviour
- Polymorphism can help that with correct objects

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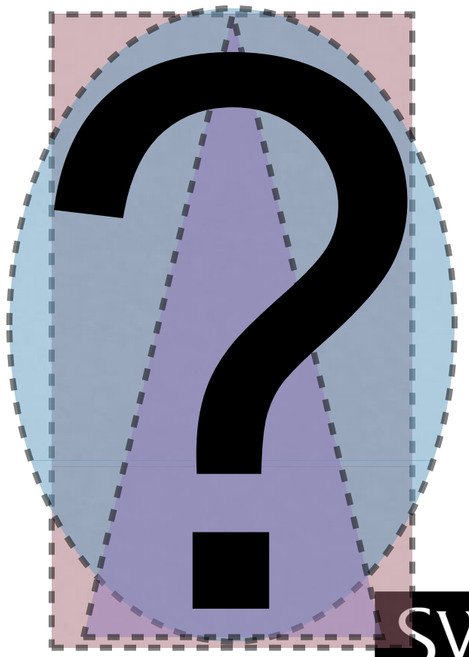
Week 4: Flexibility: Refer to a parent class, but get child objects… they work as expected!

`Shape s` $\xrightarrow{\text{Draw}}$



Shape mywhich = Rectangle/Triangle/Ellipse
mywhich.Draw()

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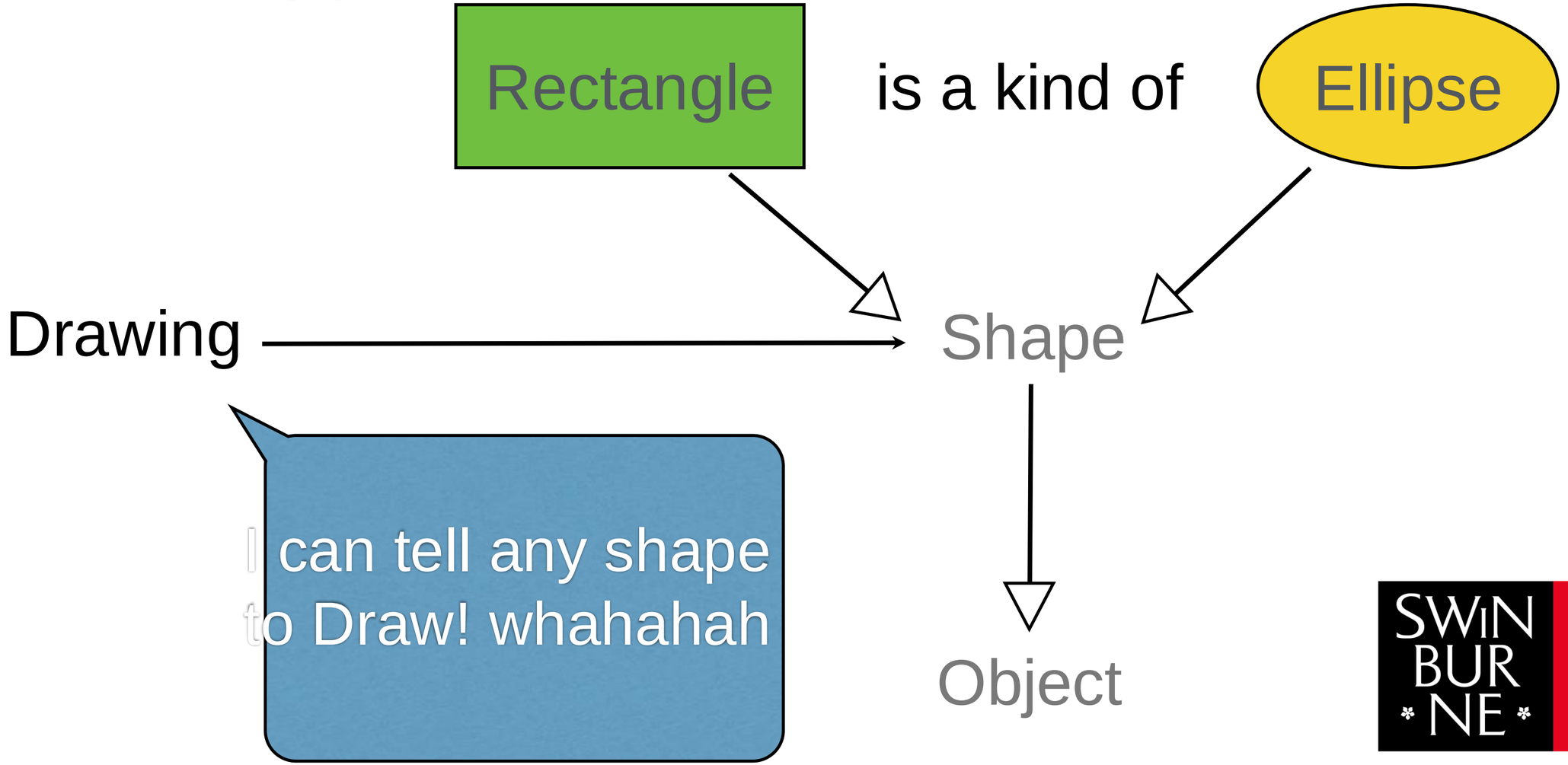
Week 5: Interfaces

Developers use inheritance to create families of types with common features



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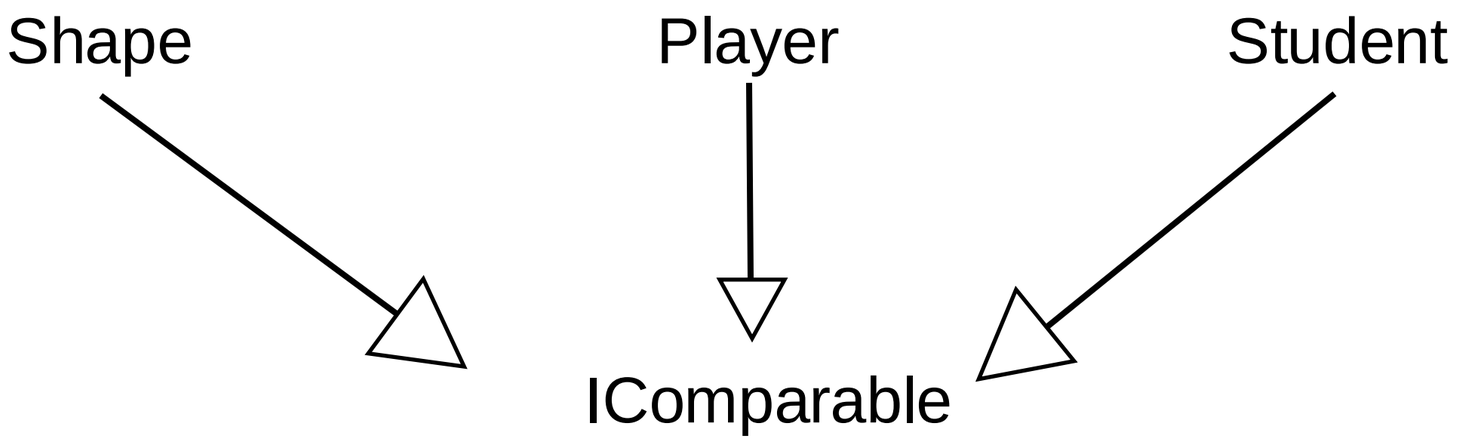
Week 5: Polymorphism means objects of this type can now be used anywhere the interface is needed




```
List<IComparable> myGenericList = new List< IComparable >();
Shape myShape = new Shape();
Player myPlayer = new Player();
myGenericList.Add(myShape);
```

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Week 5: Use catch block to deal with the error

```
try
{
    ...
}
catch (System.Exception e)
{
    // cleanup
    ...
}
```

Ok... it threw an exception. I need to clean up this mess!

Example →

```
string filePath = Console.ReadLine();
try
{
    StreamReader reader = new StreamReader(filePath)
     Console.WriteLine("File opened successfully.");
}
catch (FileNotFoundException ex)
{
     Console.WriteLine(”Error: File not found");
}
catch (IOException ex)
{
     Console.WriteLine(”Error while accessing file");
}
catch (System.Exception ex)
{
     Console.WriteLine(”Unexpected");
}
```

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Week 6: Responsibility Driven Design

- Creates effective OO designs using Roles, Responsibilities, and Collaborations
- Design before code = better code + faster written
- Emphasizes behavioral modeling
- Turns software requirements in to OO software

Wirfs-Brock, Rebecca et al. “Object Design: Roles, Responsibilities, and Collaborations.” (2002).

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Week 6: Responsibility Driven Design

Step 1: Define the purpose for objects in your program using **Roles**

Step 2: Define **responsibilities** for each candidate role

Step 3: **Collaborate** with other objects to meet responsibilities

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Week 6: Use the different kinds of relationships to help identify possible links

- Association
- Aggregation
- Dependency

→

- where to use
- clarify using software requirement/business analysis

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Week 6: Use scenarios to test how your model responds to events and implements features

Chess Game

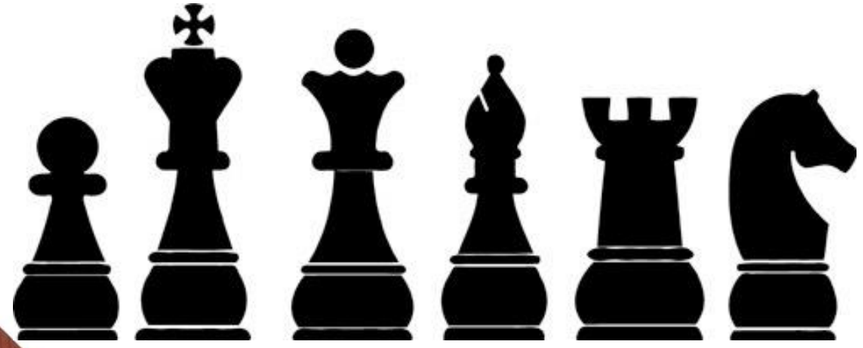
knows its Board
knows its Pieces
knows its Players
can start the game
can process a players turn

Board, setup.

Rook, exist.

Rook, this is your King.

Cell, hold this Rook.



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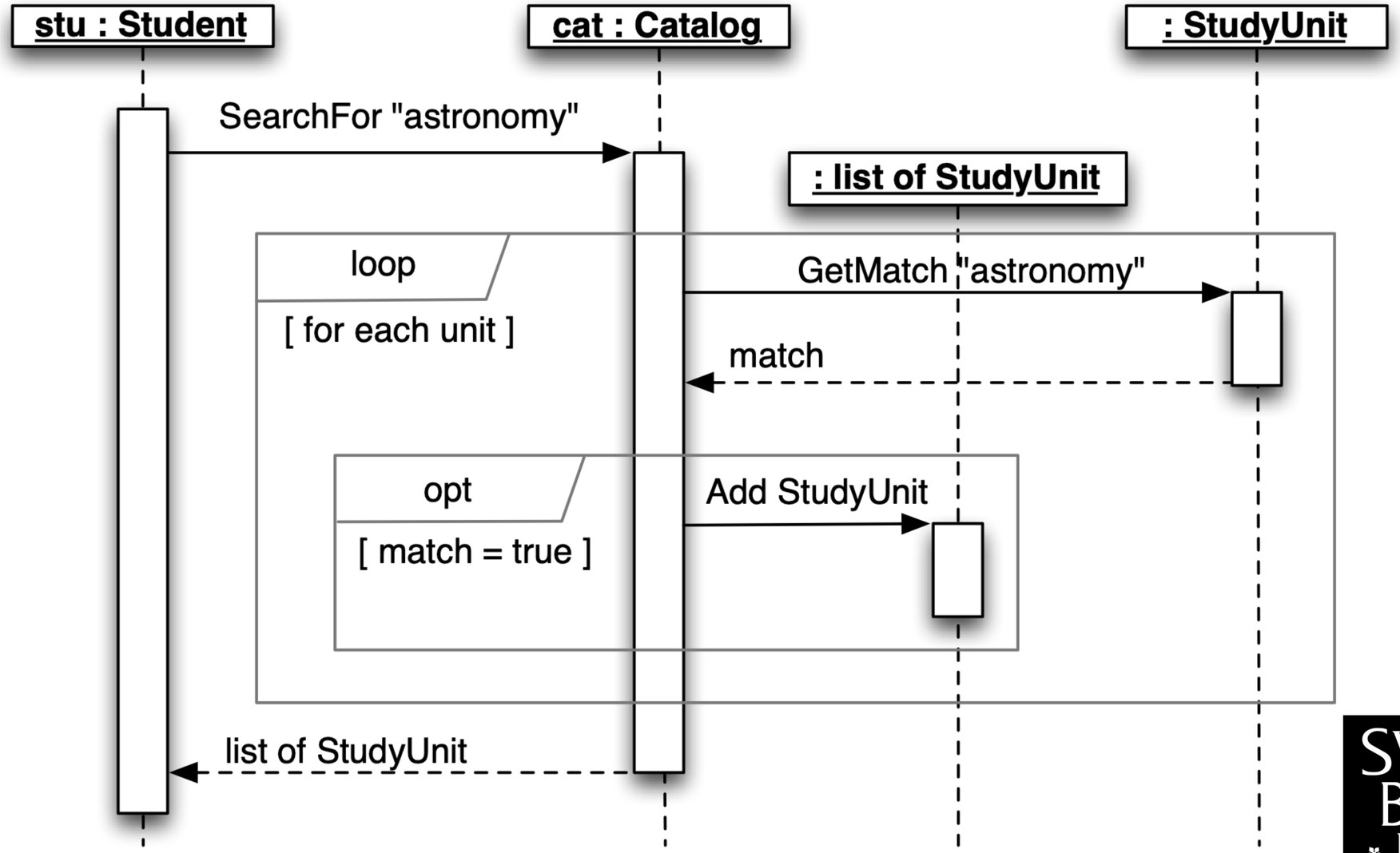
Week 6: Use Sequence Diagram to model control flow logic



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Week 7: Methods can have the same name as long as they have different parameters

```
public static void DrawRectangle(Color clr, Rectangle rect)...
public static void DrawRectangle(Color clr, Rectangle rect, DrawingOptions opts)...
public static void DrawRectangle(Color clr, double x, double y, double width, double height)...
public static void DrawRectangle(Color clr, double x, double y, double width, double height, DrawingOptions opts)
```

```
1 of 4   void SplashKit.DrawRectangle(Color clr, Rectangle rect)

SplashKit.DrawRectangle()
```

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Week 7: Scope tells us **where** a variable can be accessed

I know about a variable called ‘i’!

```
public void MethodOne()
{
    int i;

    for (i = 0; i < 10; i++)
    {
        // do something
    }
}
```

I know about a different ‘i’! Neat!

```
public void MethodTwo()
{
    int i;

    for (i = 0; i < 10; i++)
    {
        // do something
    }
}
```

Week 8: Good design is often described in terms of design goals

Extensible!

Robust!

Flexible!

Modular!

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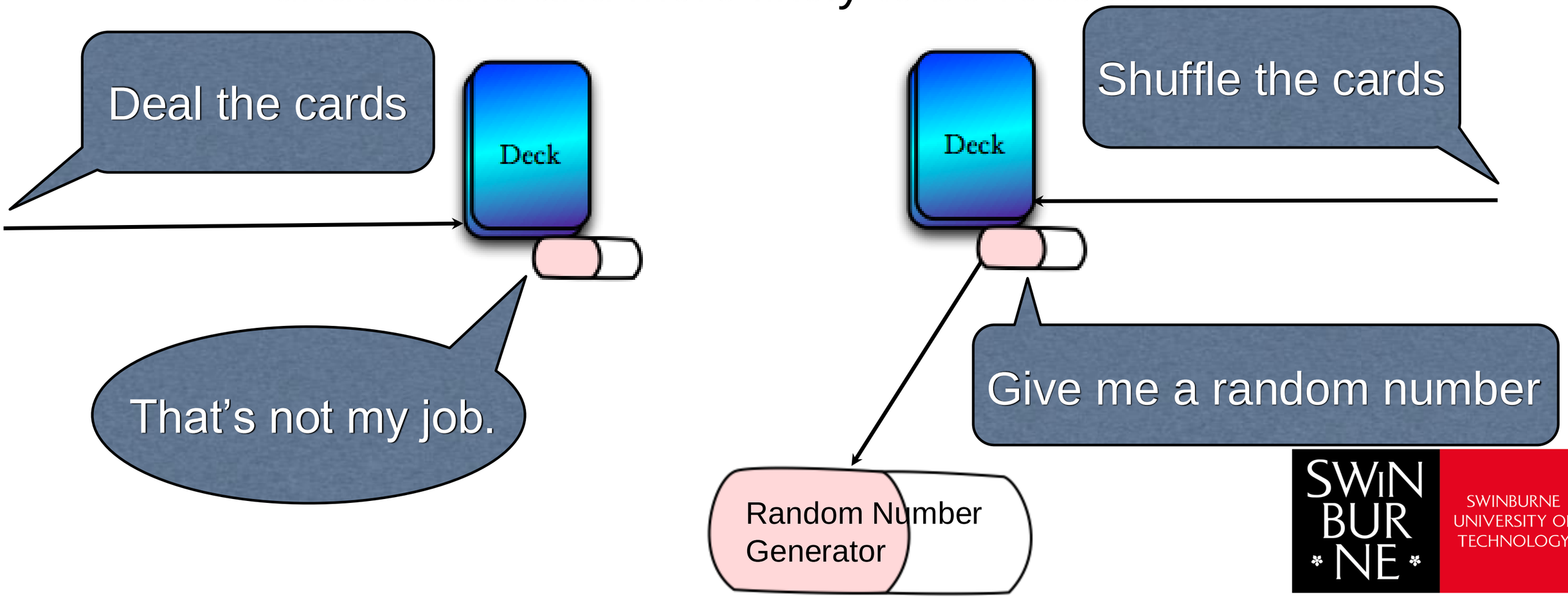
Week 8: Guideline1. Classes should be lazy

Focused classes with well-defined responsibilities are easier to understand and more likely to be reuseable



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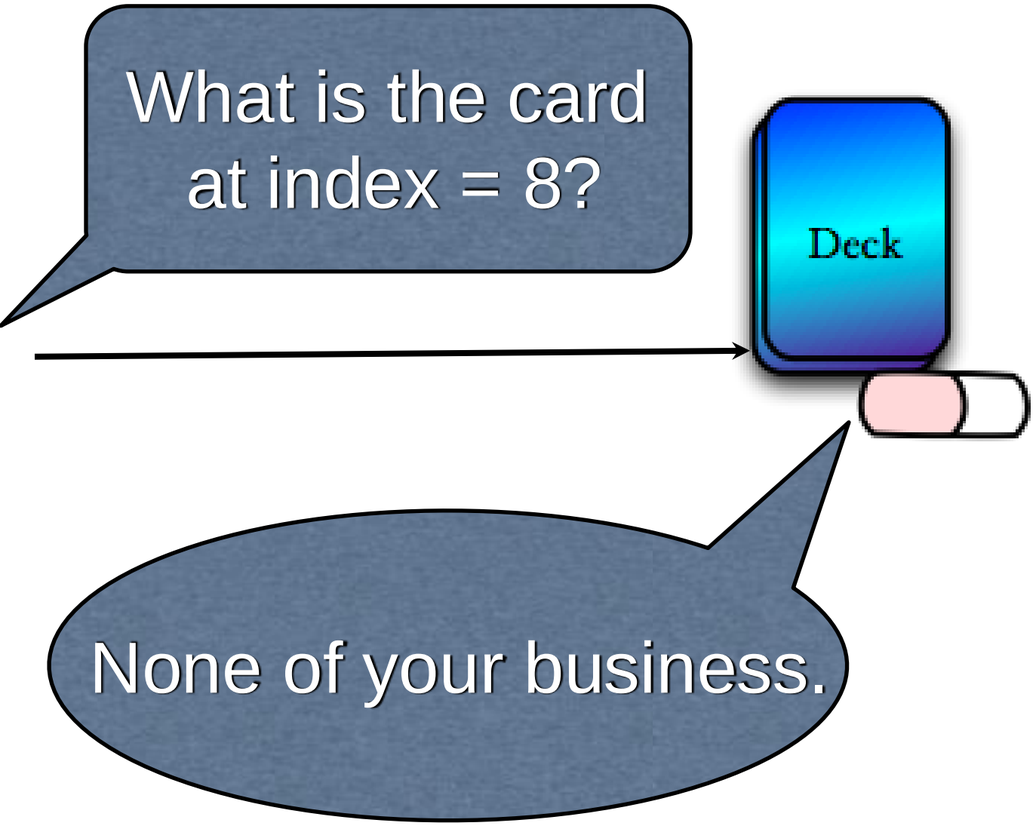
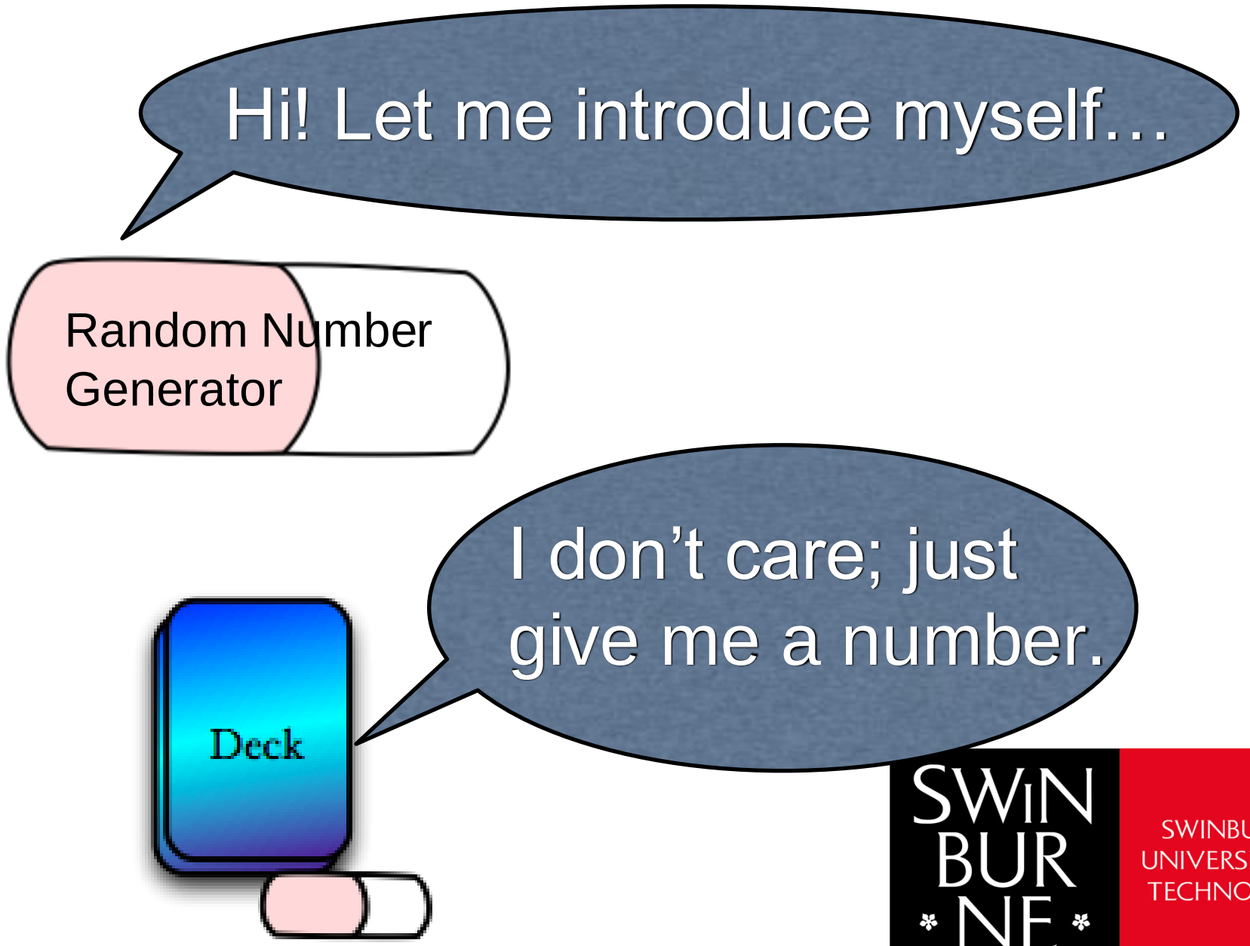
Week 8: Guideline 2. Classes should be antisocial

Class should keep details hidden, only share what is needed





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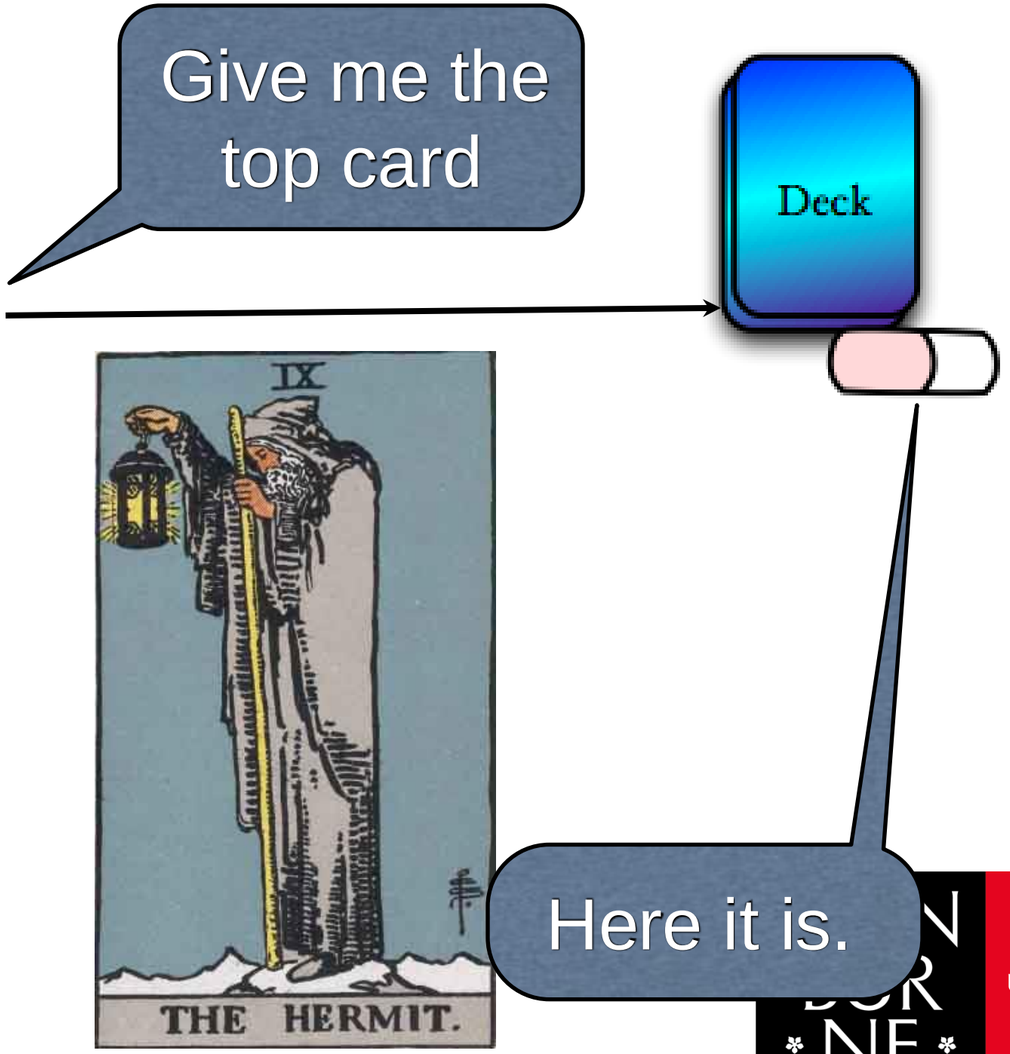
Week 8: Guideline 3. Derived classes should be conformist



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Week 8: Apply three simple rules to help evaluate object-oriented designs

Laziness
Anti-sociality
Conformity

imply to

Extensibility
Flexibility
Robustness
Modularity

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Week 9: General Responsibility Assignment Software Patterns

- Software patterns provide optimised, reusable templates to solve problems

- Good design choices

  Extensibility
  Flexibility
  Robustness
  Modularity

- GRASP

  •set of patterns containing guidelines and principles

  •provides a systematic approach to assign responsibilities to class and objects

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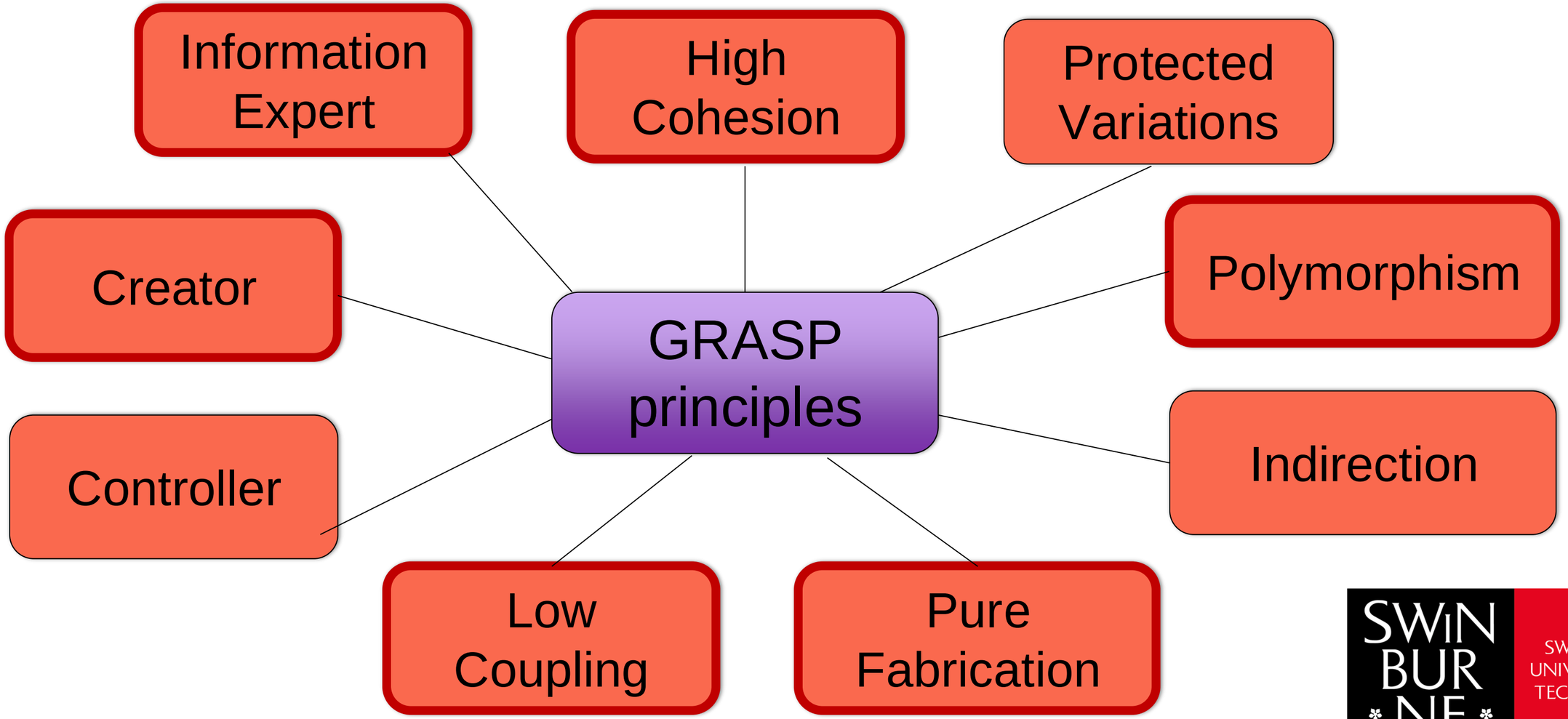
Week 9: General Responsibility Assignment Software Patterns



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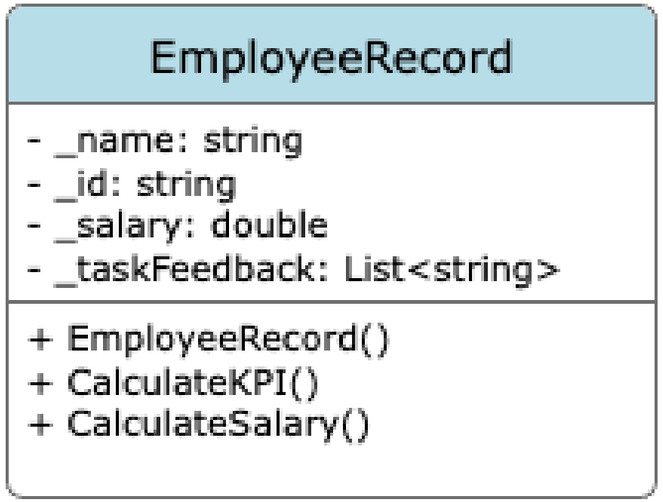
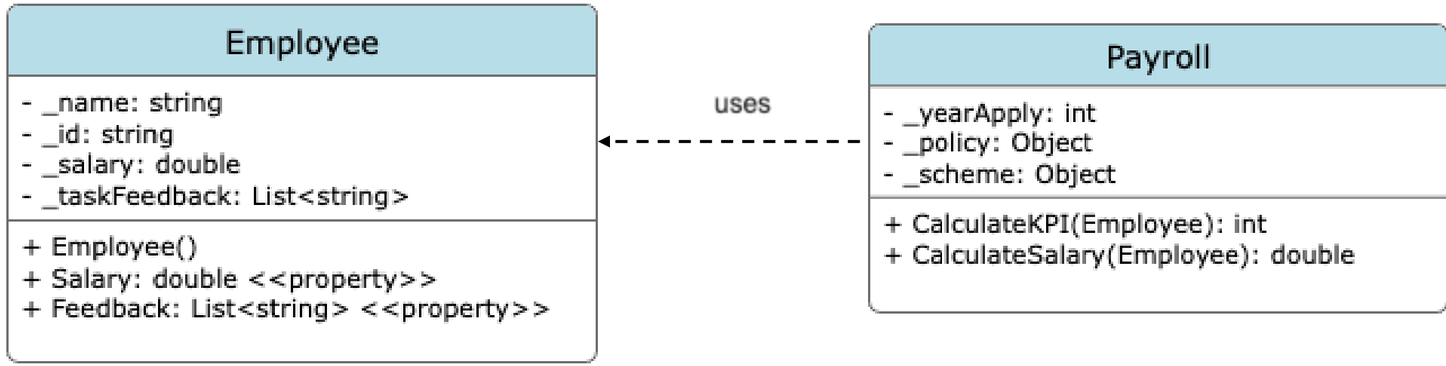
Week 9: Cohesion

The degree of strongly related functionality are described within the classes



Low Cohesion



High Cohesion

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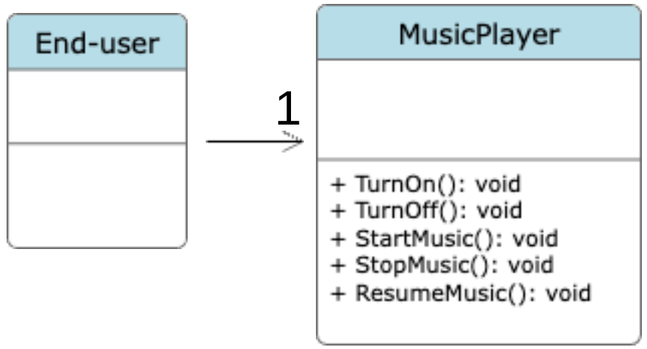
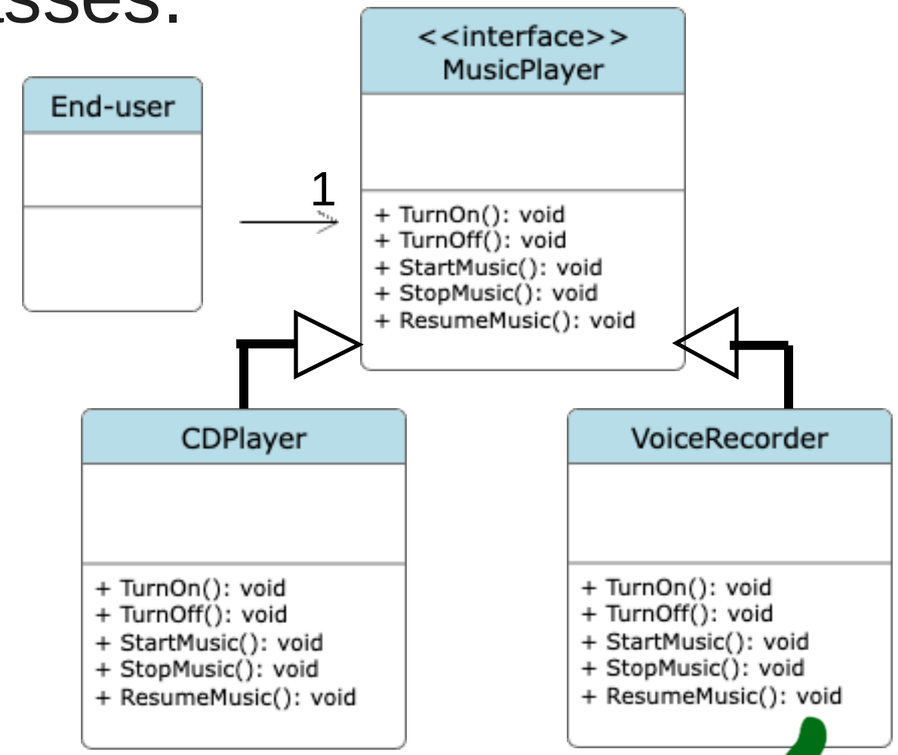
Week 9: Coupling

The degree of dependence among classes.



Tight Coupling



Loose Coupling

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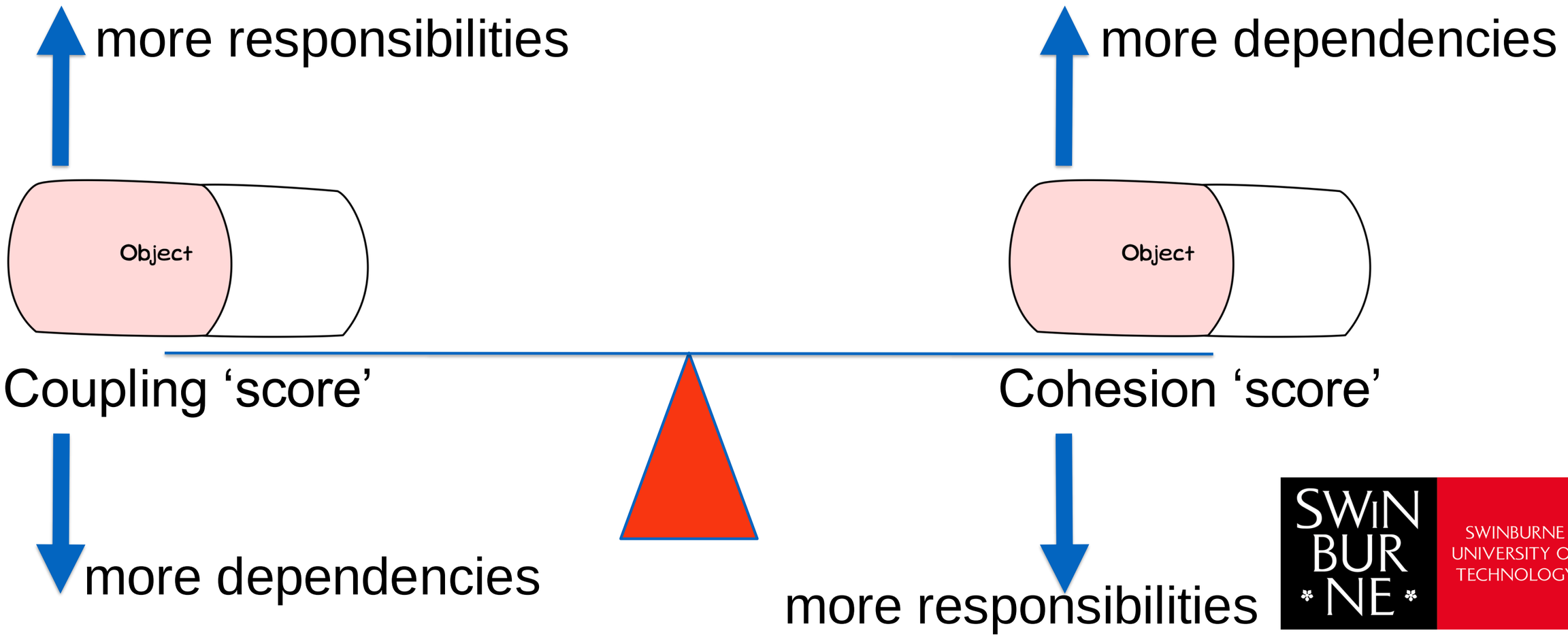
Week 9: Maintain a balance between coupling and cohesion



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Week 10: Classifications of Design Patterns

- **Structural Design Patterns:** deal with relationships between objects, making it easier for these entities to work together

- **Creational Patterns:** provide instantiation mechanisms, making it easier to create objects in a way that suits the situation

- **Behavioural Patterns:** dictate communications between objects, increasing the ease and flexibility of object communication

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Week 10: Classifications of Design Patterns

Creational

Singleton
Factory
Builder
Prototype
…

Structural

Adapter
Composite
Bridge
Proxy
Decorator
Façade
…

Behavioural

Strategy
Observer
State
Command
Visitor
…

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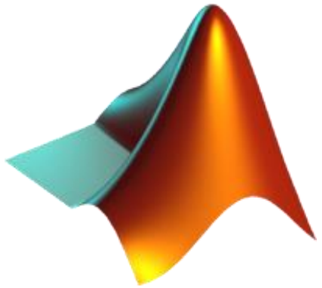
Week 11: Approach new languages armed with the principles of OOP



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Portfolio Submission

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Double check your task submissions and feedback

If not receiving feedbacks, contact tutors asap

Academic Integrity Check

Custom Project Demonstration

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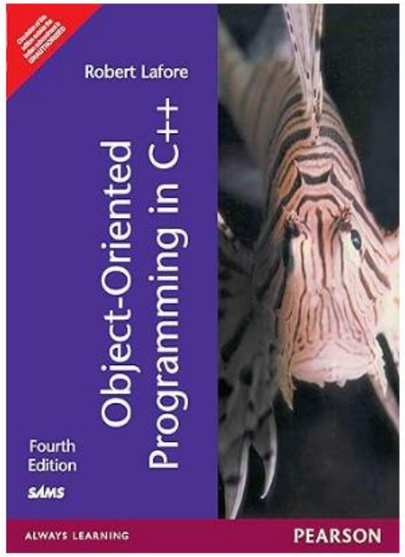
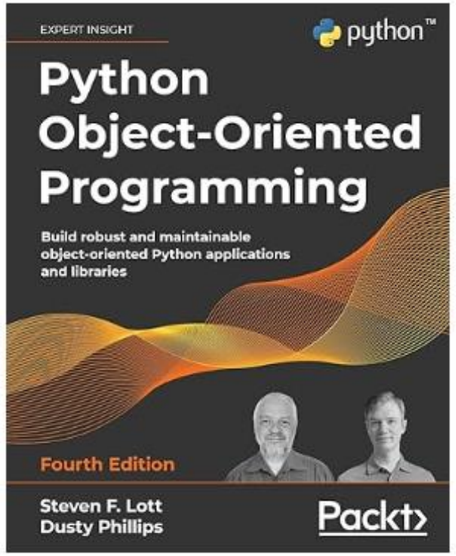
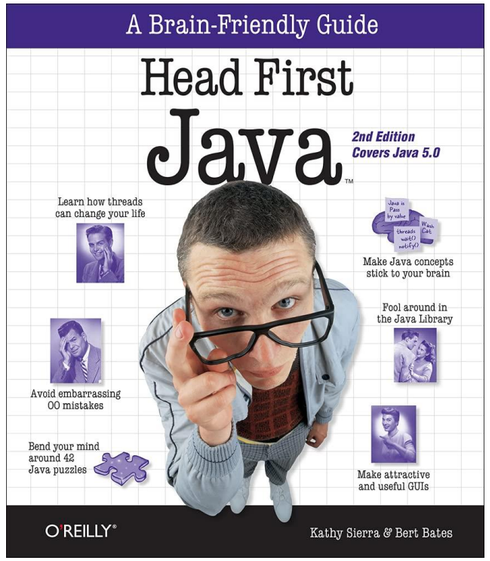
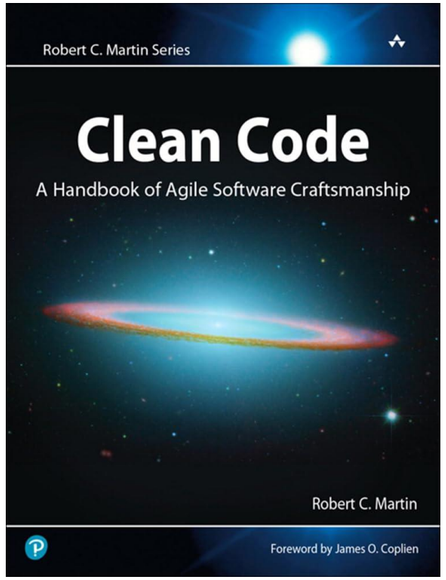
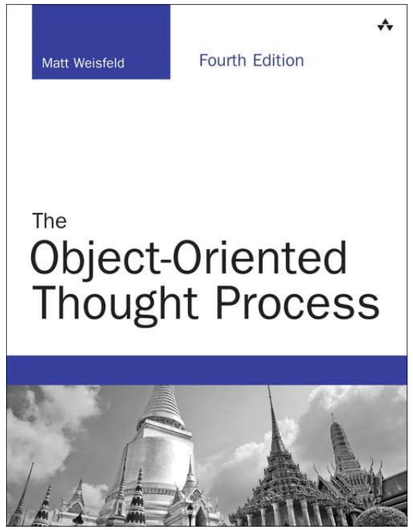
Recommended Books

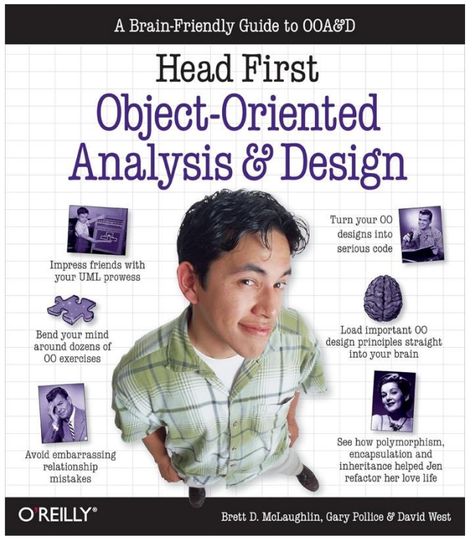


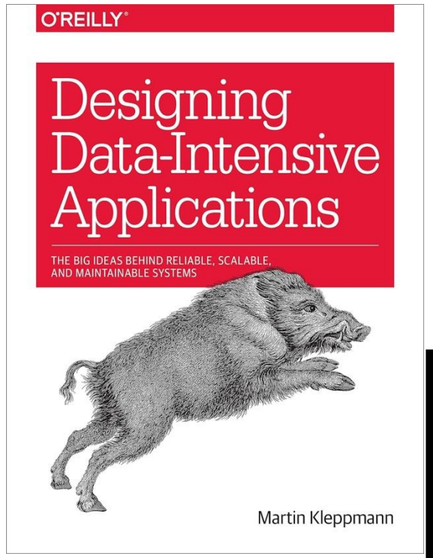












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