Usecase Diagram Contd...

Class Diagram

Examples from the Lab

Author – Identify team member who wrote this use case. We expect each team member to have at least 1 use case.

Purpose - What is the basic objective of the use-case. What is it trying to achieve?

Requirements Traceability – Identify all requirements traced to this use case - the F*n* numbers from Section 3.2 above

Priority - What is the priority. Low, Medium, High. Importance of this use case being completed and functioning properly when system is deployed

Preconditions - Any condition that must be satisfied before the use case begins

Post conditions - The conditions that will be satisfied after the use case successfully completes

<Please be careful while filling up Pre and Post conditions>

Actors – Actors (human, system, devices, etc.) that trigger the use case to execute or provide input to the use case

Extends – If this is an extension use case, identify which use case(s) it extends <Study what "extends" actually means before proceeding>

Flow of Events

1. Basic Flow - flow of events normally executed in the use-case
2. Alternative Flow - a secondary flow of events due to infrequent conditions
3. Exceptions - Exceptions that may happen during the execution of the use case

Includes (other use case IDs)

Notes/Issues - Any relevant notes or issues that need to be resolved

A sample usecase for template purpose

Use Case #15 (View My Books)

Author – Aman Singh

Purpose – User can see how many books they have added.

Requirements Traceability – F15

Priority – High. User can check their book availability.

Preconditions – User must have to be login before see him/her added books.

Post conditions – All books will showed which added by him/her.

Actors – User.

Extends – U8.

Flow of Events

1. Basic Flow – User open the Application and login. Click on view my book. Get all details.

2. Alternative Flow – None.

Includes – None.

Please note that...

- Associate the actors and use cases -- there shouldn't be any actor or use case floating without any connection
- Be careful on specifying relationships

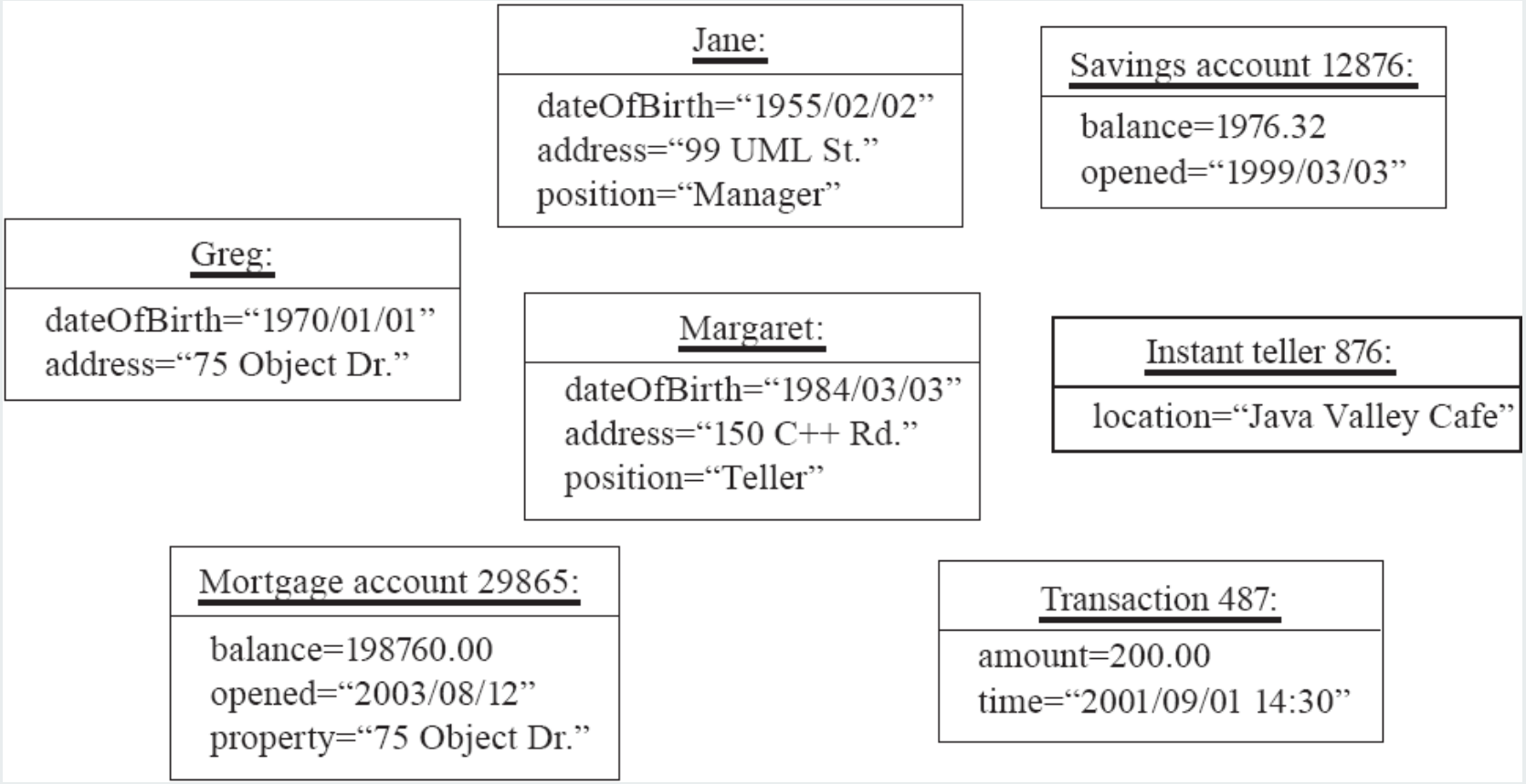
Object Oriented paradigm

An approach to the solution of problems in which all computations are performed in the context of objects.

- The objects are instances of classes, which:
  - are **data abstractions**
  - contain **procedural abstractions** that operate on the objects

- A running program can be seen as a collection of objects collaborating to perform a given task

Objects


Jane:
dateOfBirth="1955/02/02"
address="99 UML St."
position="Manager"
Savings account 12876:
balance=1976.32
opened="1999/03/03"
Greg:
dateOfBirth="1970/01/01"
address="75 Object Dr."
Margaret:
dateOfBirth="1984/03/03"
address="150 C++ Rd."
position="Teller"
Instant teller 876:
location="Java Valley Cafe"
Mortgage account 29865:
balance=198760.00
opened="2003/08/12"
property="75 Object Dr."
Transaction 487:
amount=200.00
time="2001/09/01 14:30"

Objects

Object

- A chunk of structured data in a running software system

- Has ***properties***
  - Represent its **state**

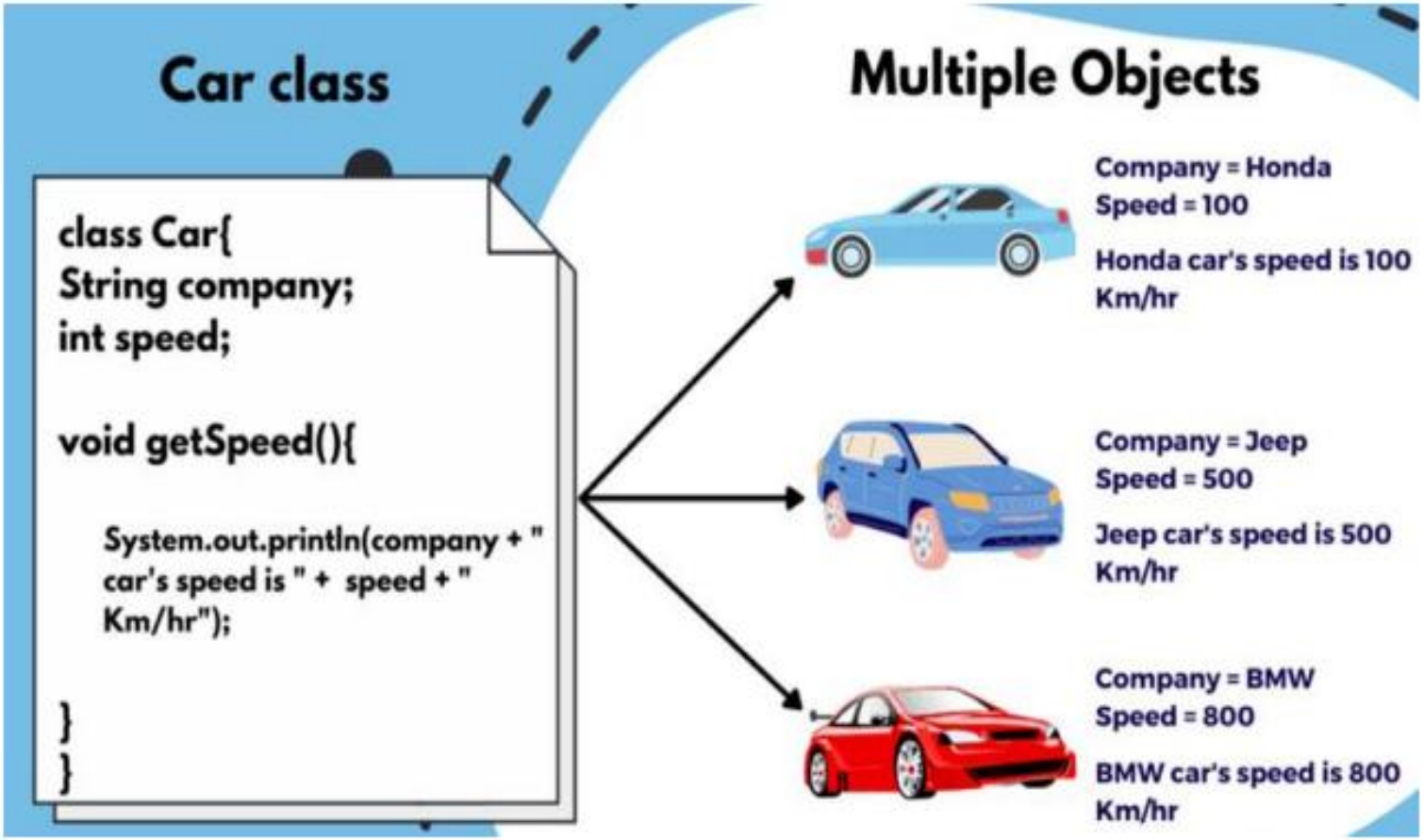
- Has ***behaviour***
  - How it **acts and reacts**
  - May simulate the behaviour of an object in the real world

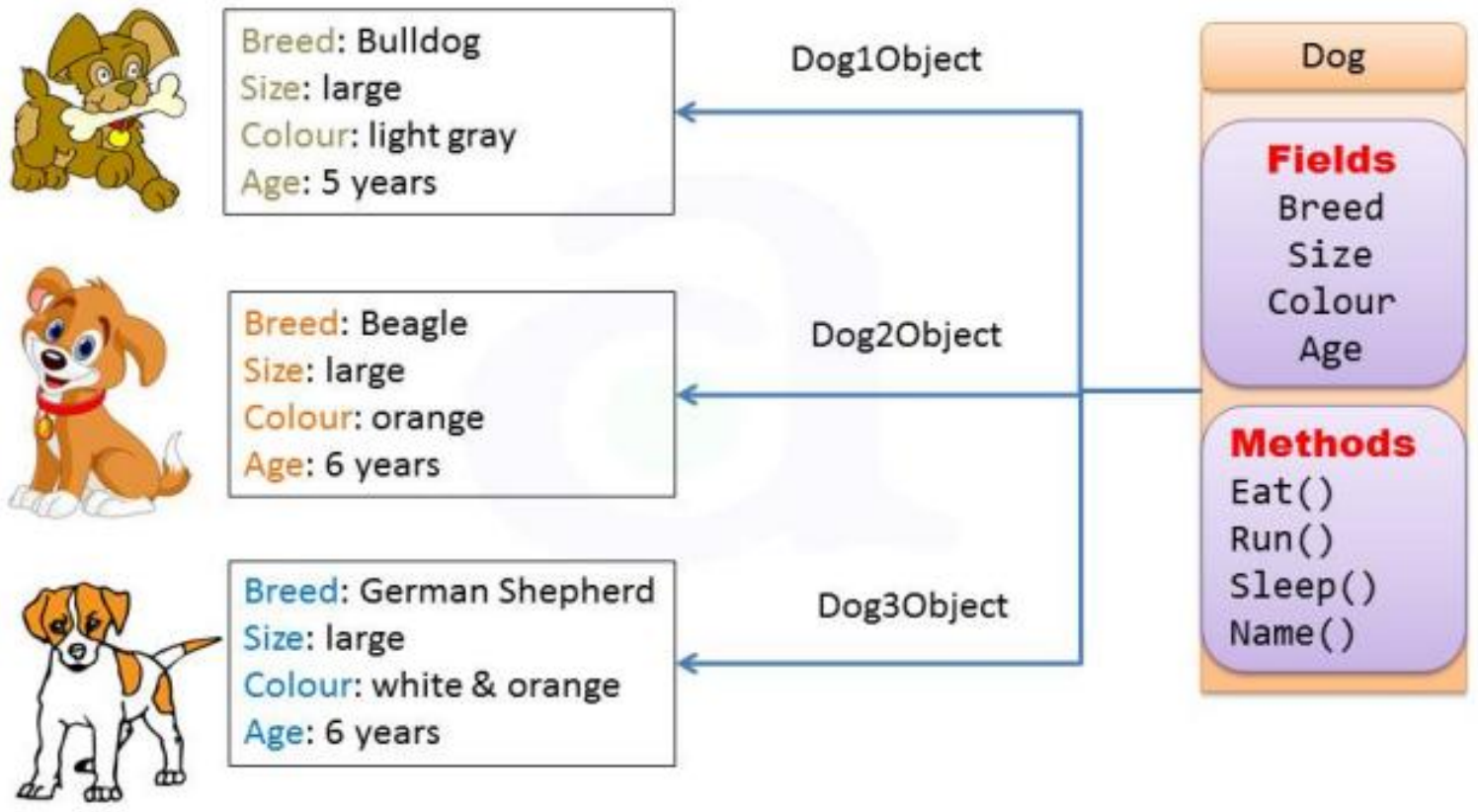
Classes

A class:

- A unit of abstraction in an object oriented (OO) program
- **Template or blueprint of objects**

- A kind of software module
  - Describes its object structure (properties)
  - Contains *methods* to implement their behaviour

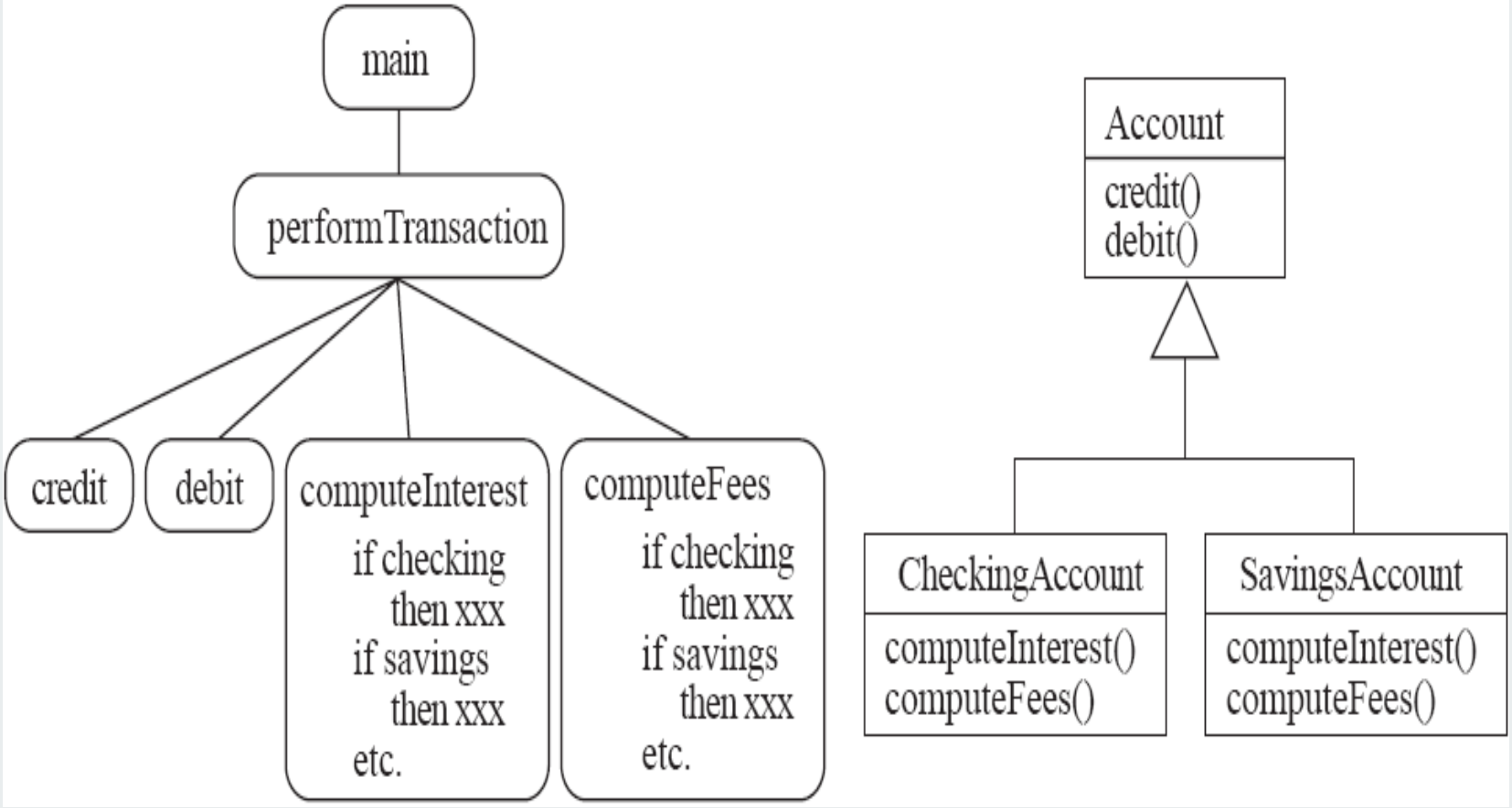

Car class
class Car{
String company;
int speed;
void getSpeed(){
System.out.println(company + "
car's speed is " + speed + "
Km/hr");
}
}
Multiple Objects
Company = Honda
Speed = 100
Honda car's speed is 100
Km/hr
Company = Jeep
Speed = 500
Jeep car's speed is 500
Km/hr
Company = BMW
Speed = 800
BMW car's speed is 800
Km/hr


Breed: Bulldog
Size: large
Colour: light gray
Age: 5 years
Dog1Object
Breed: Beagle
Size: large
Colour: orange
Age: 6 years
Dog2Object
Breed: German Shepherd
Size: large
Colour: white & orange
Age: 6 years
Dog3Object
Dog
Fields
Breed
Size
Colour
Age
Methods
Eat()
Run()
Sleep()
Name()

Is Something a Class or an Instance?

- *Student*
  - Class; instances are individual students.
- Course
  - Class; instance is CS3004 SE
- *Teacher with Employee ID – CSED100*
  - Instance of **Class Teacher**

A View of the procedural and object-oriented paradigms



Instance Variables

Variables defined inside a class corresponding to data present in each instance

- Also called *fields* or *member variables*

- Attributes
  - Simple data
  - E.g. name, dateOfBirth

- Associations
  - Relationships to other important classes
  - E.g. supervisor, coursesTaken

Variables vs. Objects

- A variable
  - *Refers* to an object
  - May refer to different objects at different points in time
  - Eg:

```
Student s1 = new Student();
s1.name = "ABC";
s1.computeGrade();
```

- An object can be referred to by several different variables at the same time

```
Student s2 = new Student();
s2 = s1;
```

- *Type* of a variable
  - Determines what classes of objects it may contain

Benefits of Object Orientation

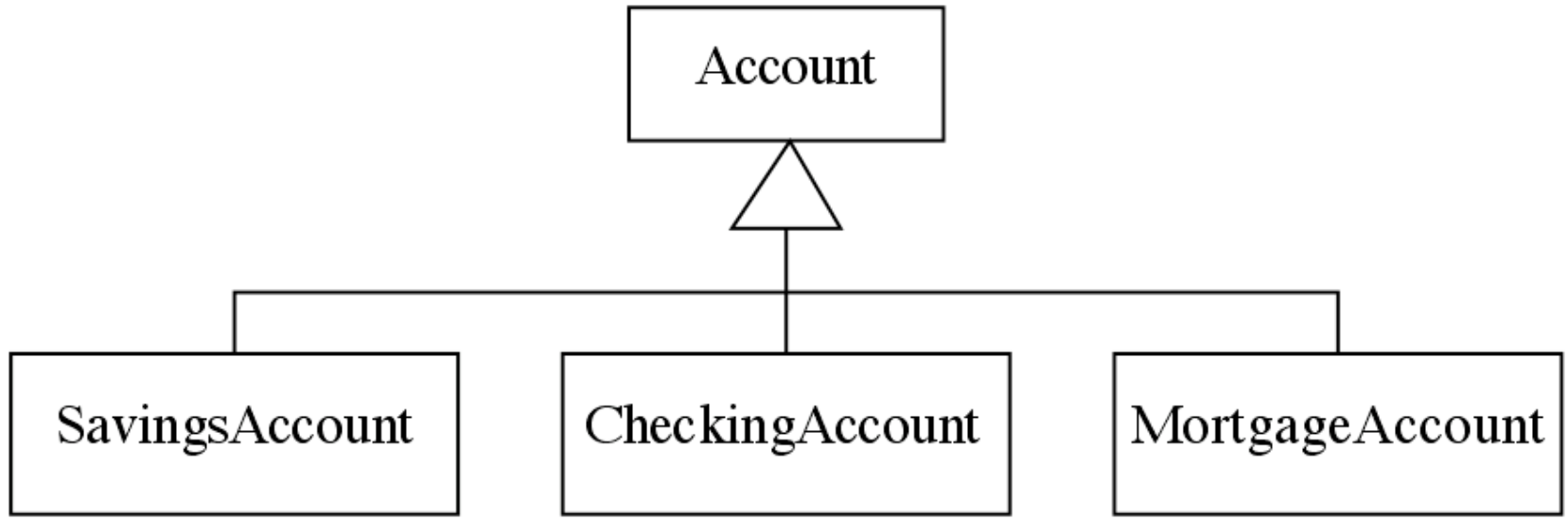
• Object technology emphasizes modeling the real world and provides us with the stronger equivalence of the real world's entities (objects) than other methodologies.

Organizing Classes into Inheritance Hierarchies

- Super classes
  - Contain features **common** to a set of subclasses

- Inheritance hierarchies
  - Show the relationships among super classes and subclasses
  - A triangle shows a *generalization*

An Example Inheritance Hierarchy

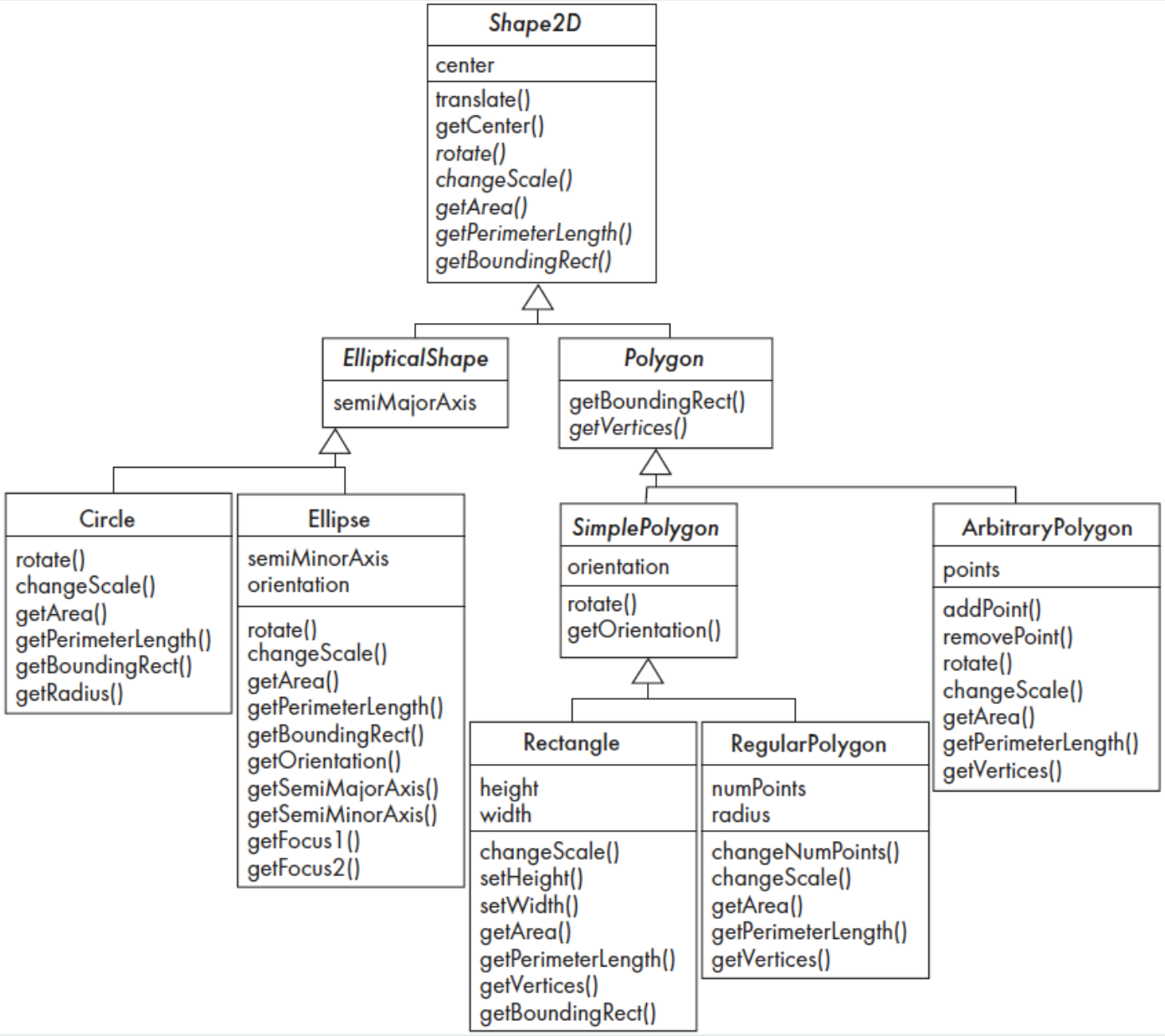


- Inheritance
  - Subclasses implicitly have the features defined in its superclasses

The Is A Rule

- Always check generalizations to ensure they obey the is a rule
  - "A checking account ***is an*** account"
  - "A student is a person"

- Is 'State' a subclass of 'Country'?
  - No, it violates the is a rule


Shape2D
center
translate()
getCenter()
rotate()
changeScale()
getArea()
getPerimeterLength()
getBoundingRect()
EllipticalShape
semiMajorAxis
Polygon
getBoundingRect()
getVertices()
Circle
rotate()
changeScale()
getArea()
getPerimeterLength()
getBoundingRect()
getRadius()
Ellipse
semiMinorAxis
orientation
rotate()
changeScale()
getArea()
getPerimeterLength()
getBoundingRect()
getOrientation()
getSemiMajorAxis()
getSemiMinorAxis()
getFocus1()
getFocus2()
SimplePolygon
orientation
rotate()
getOrientation()
ArbitraryPolygon
points
addPoint()
removePoint()
rotate()
changeScale()
getArea()
getPerimeterLength()
getVertices()
Rectangle
height
width
changeScale()
setHeight()
setWidth()
getArea()
getPerimeterLength()
getVertices()
getBoundingRect()
RegularPolygon
numPoints
radius
changeNumPoints()
changeScale()
getArea()
getPerimeterLength()
getVertices()

Polymorphism

- A property of object oriented software by which an *abstract operation may be performed in different ways* in different classes.
  - Requires **that there be *multiple methods of the same name***
  - The choice of which one to execute depends on the object that is in a variable
  - Reduces the need for programmers to code many if-else or switch statements

```
if account is of type checking then
  do something
else if account is of type savings then
  do something else
else
  do yet another thing
endif
```

Abstract Classes and Methods

- An operation should be declared to exist at the highest class in the hierarchy where it makes sense
  - The *operation* may be *abstract* (lacking implementation) at that level
  - If so, the *class* also must be *abstract*
    - No instances can be created
    - The opposite of an abstract class is a *concrete* class
  - If a super class has an abstract operation then its subclasses at some level must have a concrete method for the operation
    - Leaf classes must have or inherit concrete methods for all operations
    - Leaf classes must be concrete

Overriding

- A method would be inherited, but a subclass contains a new version instead
  - For restriction
  - For extension
  - For optimization

How a decision is made on which method to run?

```
Rectangle obj = new Rectangle();
obj.getBoundingRect();
Shape2D obj= new Rectangle();
obj.getBoundingRect();
```

1. If there is a concrete method for the operation in the current class, run that method.
2. Otherwise, check in the immediate super class to see if there is a method there; if so, run it.
3. Repeat step 2, looking in successively higher super classes until a concrete method is found and run.
4. If no method is found, then there is an error

Dynamic binding

- Occurs when decision about which method to run can only be made at *run time*
  - Needed when:
    - A variable is declared to have a superclass as its type, and
    - There is more than one possible polymorphic method that could be run among the type of the variable and its subclasses

Concepts that Define Object Orientation

- The following are necessary for a system or language to be OO
  - **Identity**
    - Each object is *distinct* from each other object, and *can be referred to*
    - Two objects are distinct *even if they have the same data*
  - **Classes**
    - The code is organized using classes, each of which describes a set of objects
  - **Inheritance**
    - The mechanism where features in a hierarchy inherit from superclasses to subclasses
  - **Polymorphism**
    - The mechanism by which several methods can have the same name and implement the same abstract operation.