Nesneye Yönelik Programlama BLM2012

Öğr. Grv. Furkan ÇAKMAK

Ders İşleyiş Bilgilendirmesi

- Teorik Ders Saatleri: **Çarşamba 14:00 - 16:50**
- Dersler şimdilik online ortamda olacak.
- Duyurular için: https://avesis.yildiz.edu.tr/fcakmak/dokumanlar
  - OBS Toplu Mesaj Sistemi
- Google Classroom Sınıf Kodu: **txgc2fe**
  - Dersle ilgili sorularınızı Classroom üzerinden duvar paylaşımı yaparak sorabilirsiniz.
- Zoom Personal Room:
  - https://us04web.zoom.us/j/3752287039?pwd=TTFKNittZWJTUEhHREovckl0VTVYUT09
  - Meeting ID: 375 228 7039
  - Passcode: 5AXMNd
- Dersle ilgili soru ve danışmalarınız için EN AZ 1 (BİR) GÜN ÖNCEDEN linkten randevu alınız.
  - https://fcakmak.simplybook.it/v2/
  - Mail ile randevu verilmeyecektir.
  - Alınan randevu saatinde eğer randevunuz online ise lütfen yukarıda verilen Zoom odasında, yüzyüze ise D-122 nolu odada bulununuz.

Ders Tanıtım Formu ve Konular

Hafta	Tarih	Konular
1	01.03.2023	Dersin ve Java Dilinin Genel Tanıtımı, Sınıflar, Nesneler, Üyeler, Final ve Static Kavramları
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12	17.05.2023	Paralel Programlamaya Giriş
13	24.05.2023	2. Ara Sınav
14	31.05.2023	Grafik User Interface (GUI) Giriş

Ders Tanıtım Formu – Ders Kitabı

	Kitaplar
1	Java How to Program, Harvey M. Deitel & Paul J. Deitel, Prentice-Hall.
2	Core Java 2 Volume I and II, C. S. Horstmann and G. Cornell, Prentice-Hall.
3	UML Distilled, Martin Fowler, Addison-Wesley

Ders Tanıtım Formu – Değerlendirme

	Yöntem	Adedi	Etki Oranı (%)
Başarı Değerlendirme Sistemi	Ara Sınavlar	2	40
	Kısa Sınavlar	-	-
	Ödevler	-	-
	Projeler	1	20
	Dönem Ödevi	-	-
	Laboratuvar	-	-
	Diğer	-	-
	Final Sınavı	1	40

Ders Tanıtım Formu - Bilgilendirme

- Ödevler, sınavlar ortak olacak
- Sınavda sınıf düzeni için 15 dk. önce gelinmeli
- İmza tükenmez kalem ile olmalı
- Yoklama
  - Teorik ders: %70 (< F0)
  - Laboratuvar dersi: %80 (< F0)
- İmza nedir? Neden atılır?
  - Vekalet yok !
- İletişim: fcakmak@yildiz.edu.tr

JAVA

- JAVA
  - JAVA SE
    - Programlama Metodolojisi Desteği
      - Procedural programming
      - Object-oriented programming
      - Generic programming
      - Functional programming
  - JAVA EE
  - JAVA ME

NYP Kavramları

- Niye NYP?
  - Nesneler tekrar kullanılabilir.
- Sınıf (Class)
- Nesne (Object)
- Metot (Method)
- Üye Alan (Attribute - Behaviors)
- Instance
- Encapsulation
- Kalıtım (Inheritance)
- Arayüzler (Interfaces)
- The UML (Unified Modeling Language)
- JRE
- JDK

Sabırla Dinlediğiniz İçin Teşekkürler

Öğr. Grv. Furkan Çakmak

Nesneye Yönelik Programlama BLM2012

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BLM2012 Nesneye Yönelik Programlama Hafta 1

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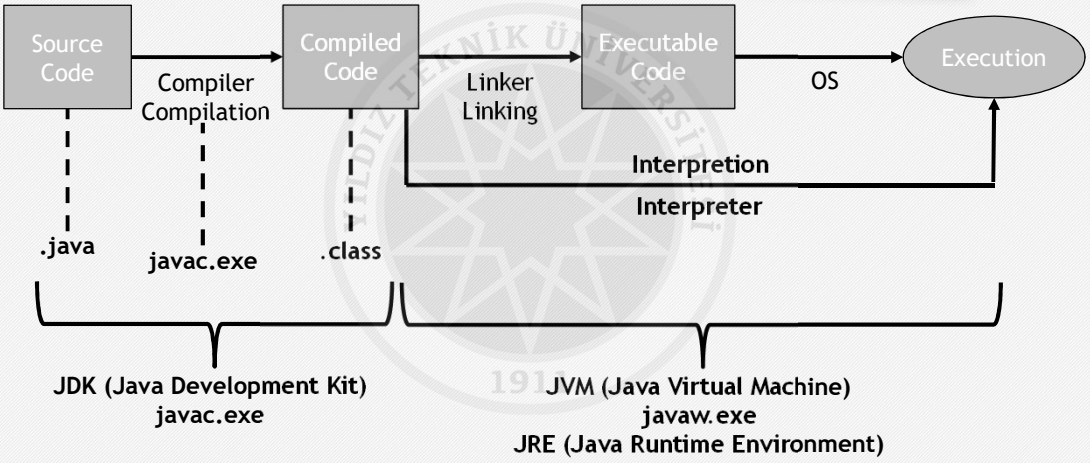
JAVA EXECUTION ENVIRONMENT



UML Representation (Sequence/Interaction Diagram)

BLM2012
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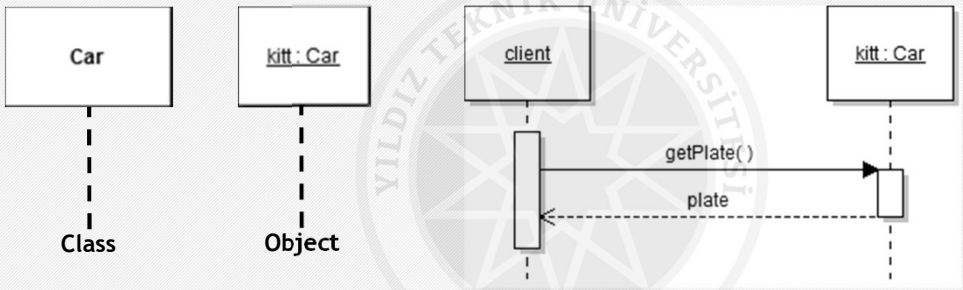
Yönelik
Programlama
Hafta 2



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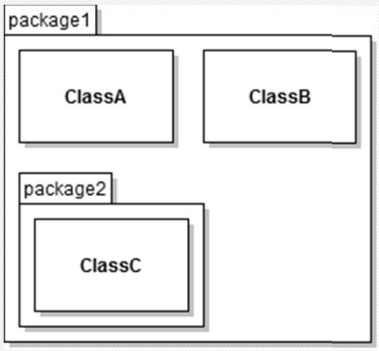
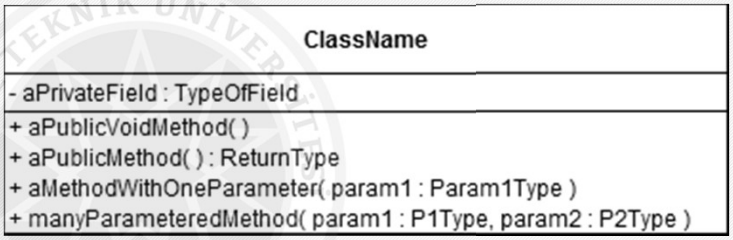
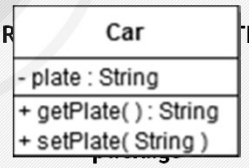
UML Representation (Devam) (Sequence/Interaction Diagram)





VISIBILITY R ION HIDING

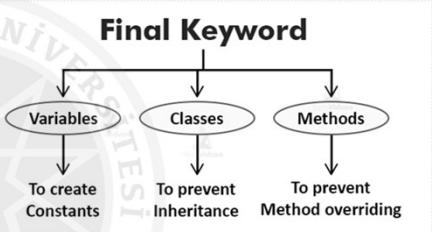


SPECIAL CASES OF MEMBERS

BLM2012 Nesneye Yönelik Programlama Hafta 2

- Static member fields
- Static member methods
- Final variables, Classes, Methods

- Final: Only once
- Static: Shared usage



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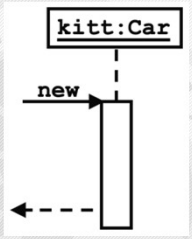
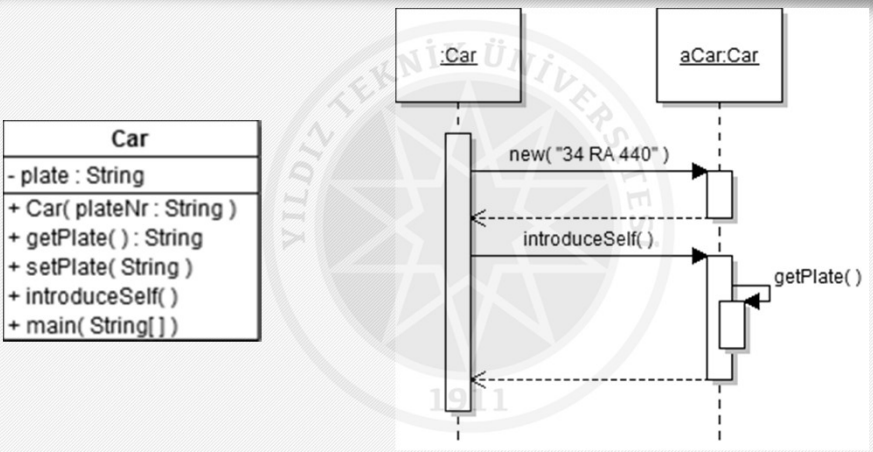
CONSTRUCTORS AND FINALIZERS

- Constructor Method
  - Overloading
- Finalizing Method
  - object.finalize()



CREATING YOUR OWN CLASS AND OBJECTS



PRIMITIVES AND WRAPPERS

- Wrapper?
  - You can think of a wrapper as a class with only one member field of a primitive type that it wraps/boxes.
  - java.lang

  - int compareTo(Integer anotherInteger)
  - int intValue()
  - static int parseInt(String s)
  - String toString()
  - static String toString(int i)
  - static Integer valueOf(String s)

String Class

- int length()
- int compareTo(String anotherString)
- int compareToIgnoreCase(String str)
- boolean equals(String anotherString)
- boolean equalsIgnoreCase(String anotherString)
- boolean contains(String anotherString)
- String toUpperCase( )
- String toLowerCase( )

Math Class

- random()
- abs(<primitive> a)
- max(<primitive> a, b)
- min(<primitive> a, b)
- ceil(double a)
- floor(double a)
- round(double a)
- sqrt(double a)

More on Random Values (java.util.Random)

- public boolean nextBoolean( ) returns [false, true]
- public double nextDouble( ) returns [0.0, 1.0)
- public float nextFloat ( ) returns [0.0, 1.0)
- public int nextInt( ) returns (-232, 232)
- public int nextInt(int bound) returns [0, bound)
- public long nextLong( ) returns [0, 248)

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Nesneye Yönelik Programlama BLM2012

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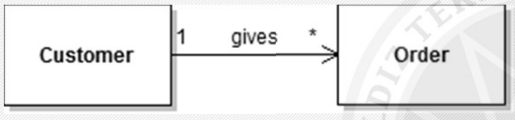
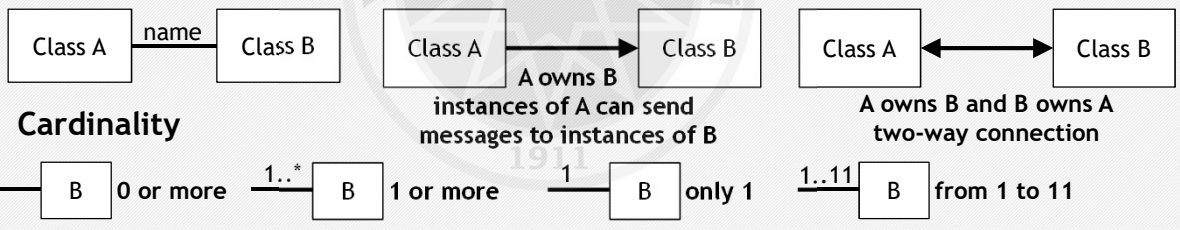
RELATIONSHIPS BETWEEN OBJECTS AND CLASSES

- Association
- Dependency
- Aggregation
- Composition
- Inheritance

ASSOCIATION

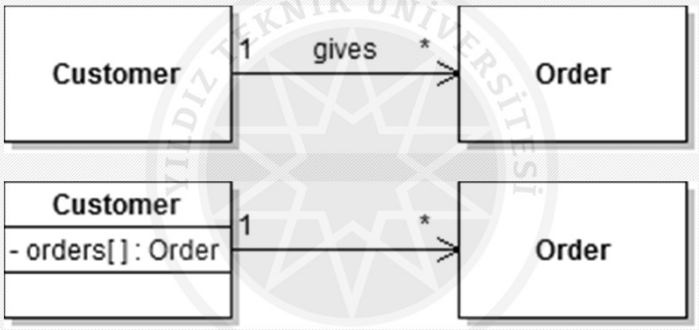
- The essence of association is ownership (SAHİPLİK).





Cardinality

ASSOCIATION - HIDDEN INFORMATION

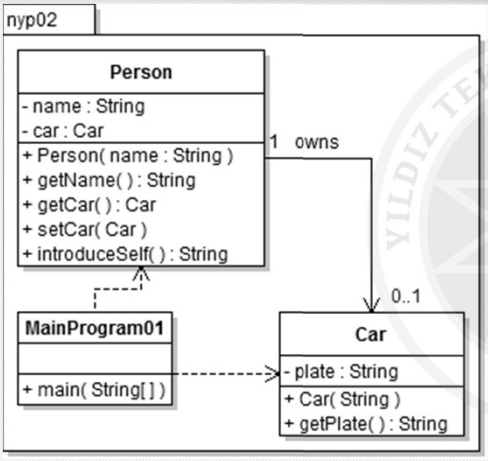


DEPENDENCY

- The essence of dependency is either **being a parameter of a method** or **temporary usage**, without ownership.

A depends on B
instances of A can send messages to instances of B in the body of aMethod.

ASSOCIATION – ONE WAY




```
package nyp02;
public class Person {
    private String name;
    private Car car;

    public Person( String name ) {
        this.name = name;
    }
    public String getName( ) {
        return name;
    }
    public void setCar( Car car ) {
        this.car = car;
    }
    public Car getCar( ) {
        return car;
    }
    public String introduceSelf( ) {
        String intro;
        intro = "Hello, my name is " + getName();
        if( car != null )
            intro += "and I have a car with license plate "
            + car.getPlate()+ ".";
        return intro;
    }
}
```


ASSOCIATION – Sequence Diagram

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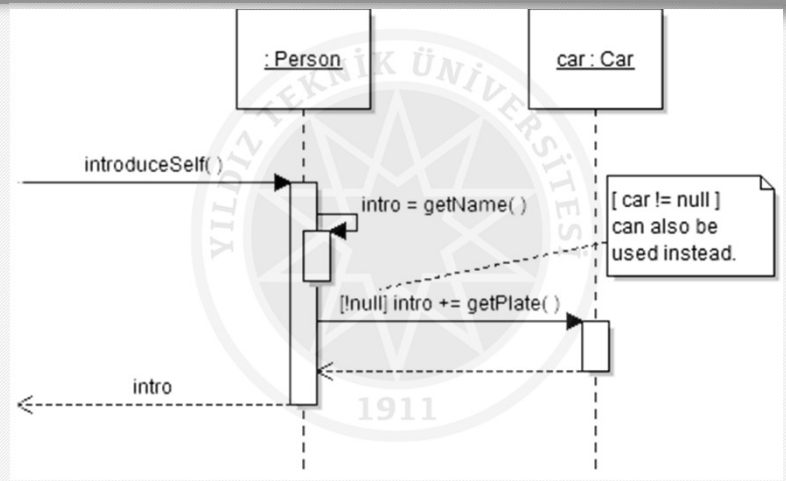
Yönelik
Programlama
Hafta 3



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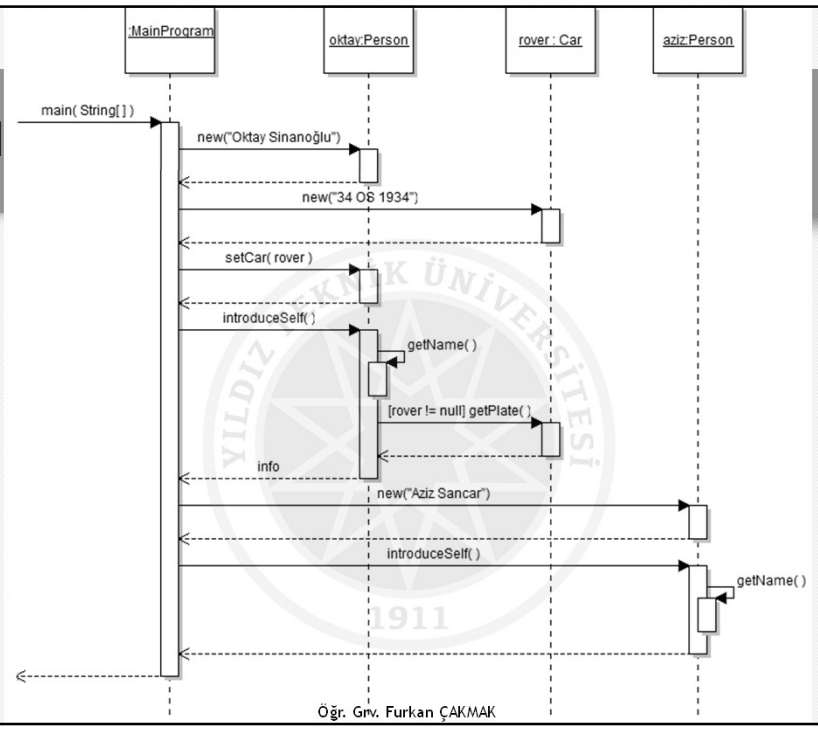
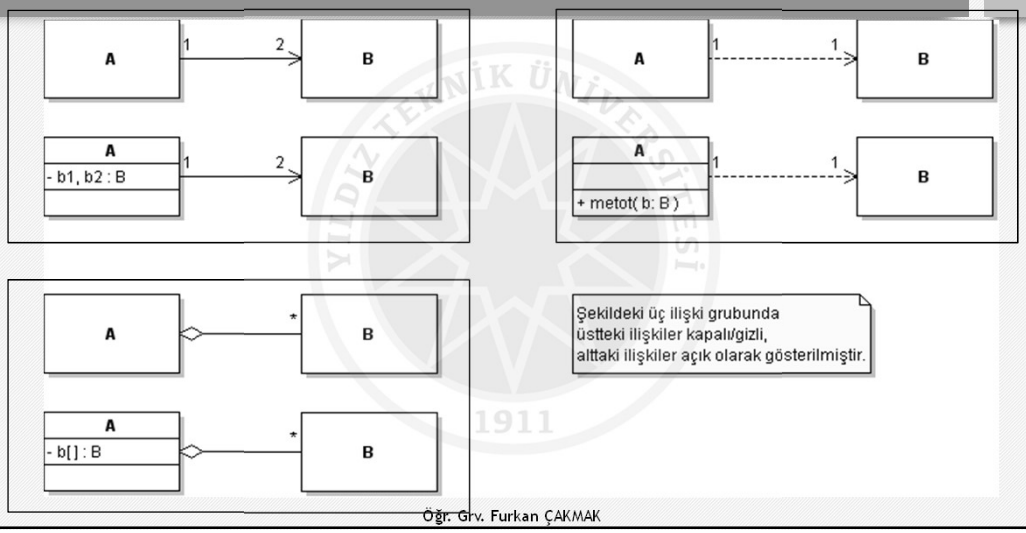
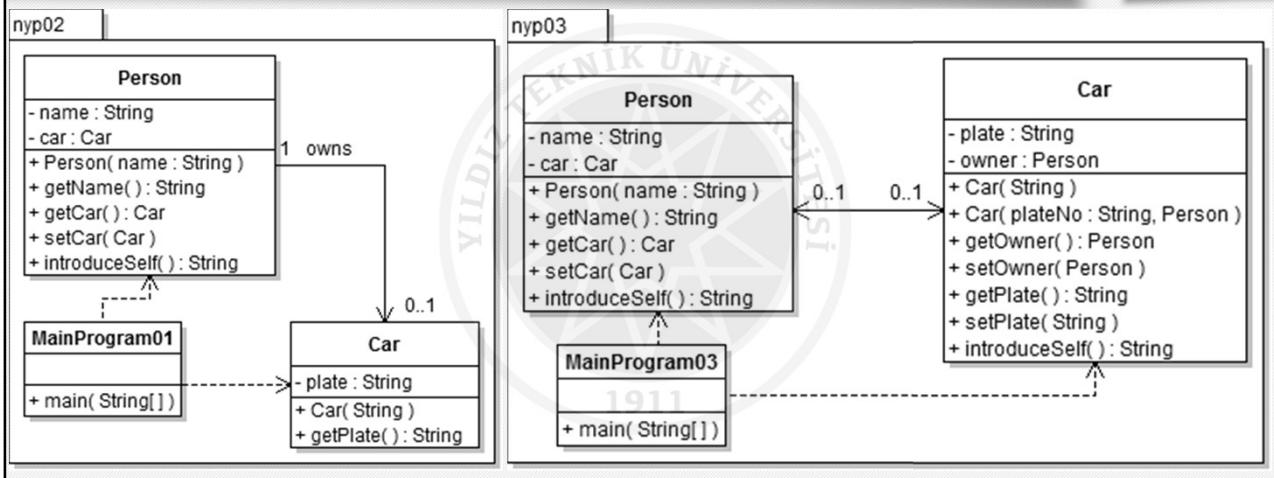
ASSOCI



ASSOCIATION – HIDDEN INFORMATION



ASSOCIATION – TWO WAY



ASSOCIATION – TWO WAY (Devam)

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Programlama
Hafta 3

```
package nyp03;
public class Car {
   private String plate;
   private Person owner;

   public Car( String plate ) { this.plate = plate; }
   public Car( String plate, Person owner ) {
     this.plate = plate;
     this.owner = owner;
   }
   public void setOwner( Person owner ) { this.owner = owner; }
   public Person getOwner() { return owner; }
   public String getPlate( ) { return plate; }
   public void setPlate( String plate ) { this.plate = plate; }
   public String introduceSelf( ) {
     String intro;
     intro = "[CAR] My license plate is " + getPlate();
     if( owner != null )
          intro += " and my owner is " + owner.getName();
     return intro;
   }
}
```

```
package nyp03;
public class MainProgram02 {
public static void main(String[] args) {
     Person oktay = new Person("Oktay Sinanoğlu");
     Car rover = new Car("06 OS 1934");
     oktay.setCar(rover);
     rover.setOwner(oktay);
     System.out.println( oktay.introduceSelf() );
     System.out.println( rover.introduceSelf() );

     Person aziz = new Person("Aziz Sancar");
     Car honda = new Car("47 AZ 1946");
     aziz.setCar(honda);
     honda.setOwner(aziz);
     System.out.println( aziz.introduceSelf() );
     System.out.println( honda.introduceSelf() );
   }
}
```

?

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ASSOCIATION – TWO WAY (Devam)


```
package nyp03b;
public class Person {
      /*the rest is the same*/
      public void setCar( Car car ) {
            this.car = car;
            if( car.getOwner() != this )
                  car.setOwner(this);
      }
}

package nyp03b;
public class Car {
      /*the rest is the same*/
      public void setOwner( Person owner ) {
            this.owner = owner;
            if( owner.getCar() != this )
                  owner.setCar(this);
      }
}
```

Attention!

Attention!

ASSOCIATION – TWO WAY (Devam)


```
package nyp03c;
public class Car {
   private String plate;
   private Person owner;

   public Car( String plate ) { this.plate = plate; }
   public Car( String plate, Person owner ) {
     this.plate = plate;
     setOwner(owner);
   }
   public void setOwner( Person owner ) { this.owner = owner; }
   public Person getOwner() { return owner; }
   public String getPlate( ) { return plate; }
   public void setPlate( String plate ) { this.plate = plate; }
   public String introduceSelf( ) {
     String intro;
     intro = "[CAR] My license plate is " + getPlate();
     if( owner != null )
          intro += " and my owner is " + owner.getName();
     return intro;
   }
}
```

Attention!

```
package nyp03c;
public class MainProgram03 {
     public static void main(String[] args) {
          Person oktay = new Person("Oktay Sinanoğlu");
          Car rover = new Car("06 OS 1934", oktay);
          System.out.println( oktay.introduceSelf() );
          System.out.println( rover.introduceSelf() );
     }
}
```

Sabırla Dinlediğiniz İçin Teşekkürler

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Hafta 3

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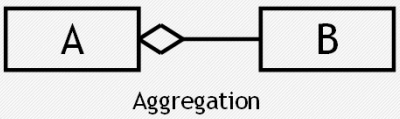
RELATIONSHIPS BETWEEN OBJECTS AND CLASSES

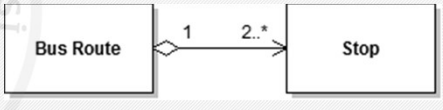
- **Association**
- **Dependency**
- Aggregation
- Composition
- Inheritance

AGGREGATION

- Represents a weak **whole-part relationship**
- **A instances has multiple B instances.**
- **A: Whole, B: Part.**
- Even if it is not shown in the diagrams, aggregation implies the following:
  - 1 on the diamond end
  - * (multiplicity) and arrow on the other end
- Agrregation is stronger than association, but only conceptually.
  - It implies that this relation has stronger rules than a regular association.
  - For example, a bus route consists of at least 2 stops and there are rules for adding a new stop to a route.

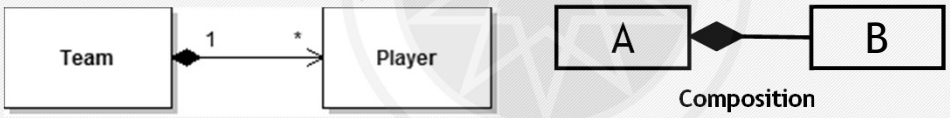


Aggregation



COMPOSITION

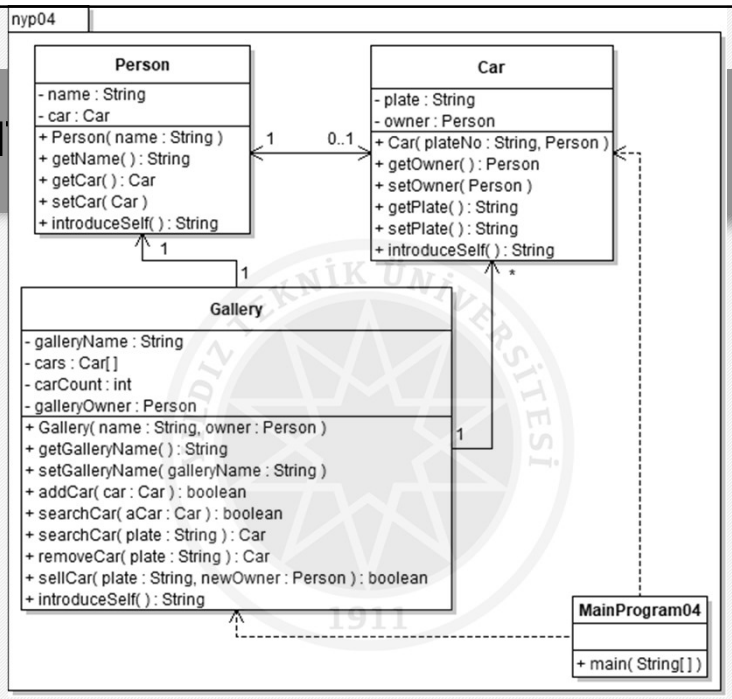
- Similar to aggregation, but represents a **stronger whole-part** relation.
- The strength of composition over aggregation is that in composition, the part can only belong to one whole at the same time.



1..*
ASSOCIATION, AGGREGATION AND COMPOSITION

- Implementation of 1..* association, aggregation and composition is similar.
- In order to implement multiplicity, we must choose a data structure:
  - Arrays, lists, stacks, queues, heaps, trees, graphs, etc.

COMPOSI



Sabırla Dinlediğiniz İçin Teşekkürler

BLM2012
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Hafta 4

Nesneye Yönelik Programlama BLM2012

Öğr. Grv. Furkan ÇAKMAK

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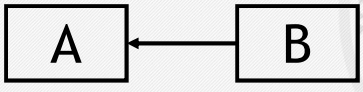
RELATIONSHIPS BETWEEN OBJECTS AND CLASSES

- **Association**
- **Dependency**
- Aggregation
- Composition
- Inheritance

INHERITANCE

- Real world: A child inherits genetic properties from his/her parents.
- OOP: A means of creating new classes from an existing class, in a way that is similar with the real world.



Inheritance

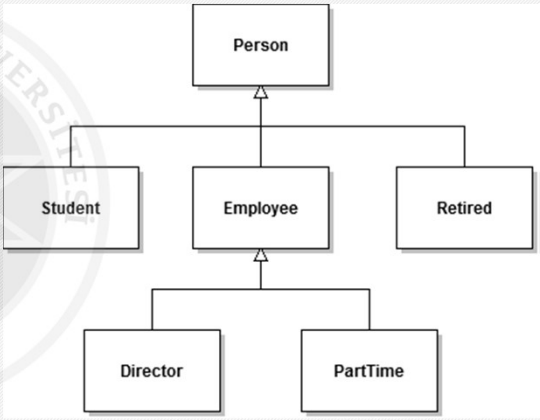
Parent class
Super class
Base class

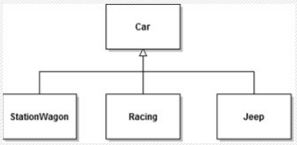
Child class
Sub class
Derived class

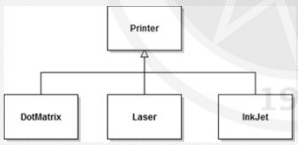
- private
 # protected

INHERITANCE (Devam)

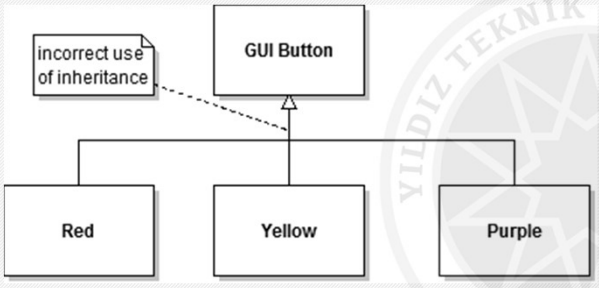
- Override
  - Final methods cannot be overridden.
- New members can be added to sub classes.
- Inheritance hierarchy / Inheritance tree
- Inheritance is also called as the generalization – specialization relation

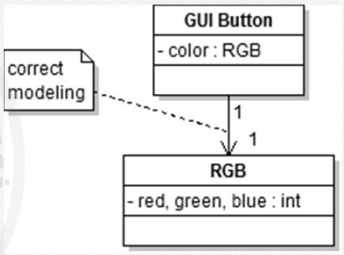




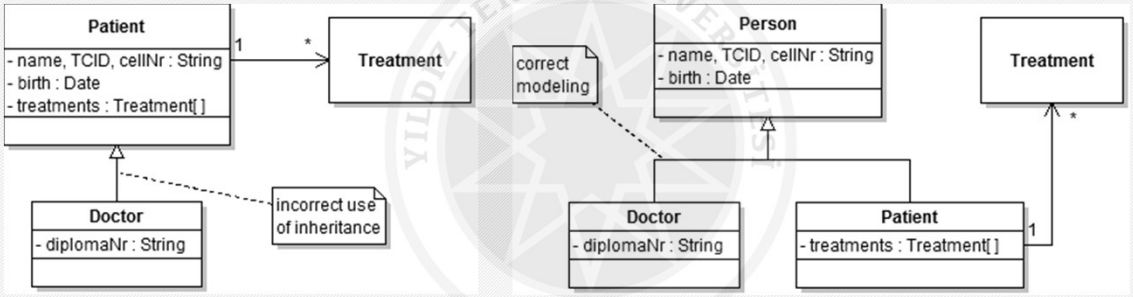


Misuse of Inheritance





Misuse of Inheritance (Devam)



INHERITANCE (Devam)

- Evaluation of inheritance relationship:
  - Inheritance is a class-level relationship that cannot be changed during runtime.
  - Experienced object oriented modelers choose inheritance only if there is a clear gen-spec. relationship. Otherwise, association, composition or aggregation (object-level relationships) is used.
  - Correct use of inheritance is an important part of every design pattern, a subject that must be studied by people who want to be software professionals after complete study of object orientation.

POLYMORPHISM and OVERRIDING

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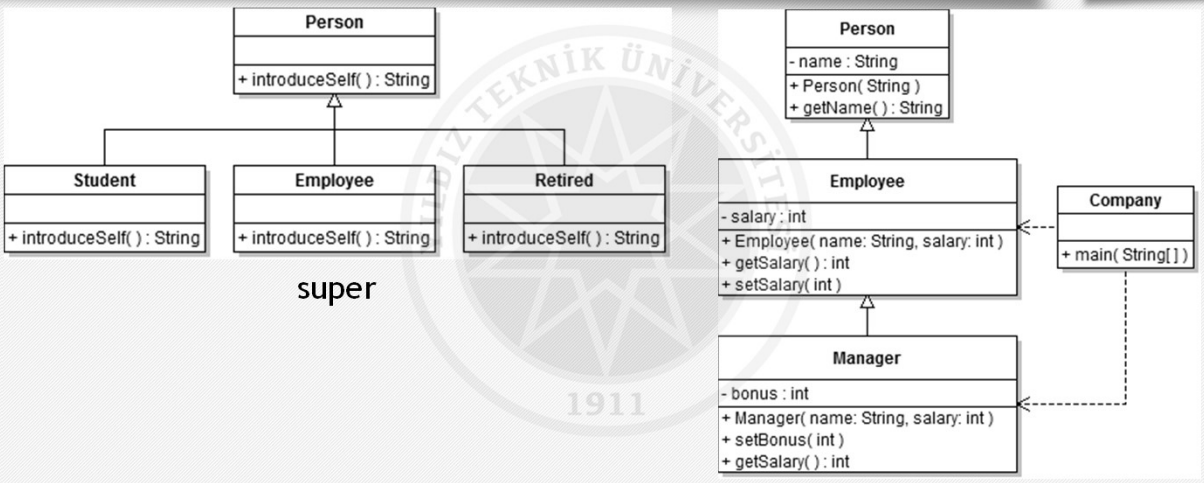

Sabırla Dinlediğiniz İçin Teşekkürler

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Hafta 4

Nesneye Yönelik Programlama BLM2012

Öğr. Grv. Furkan ÇAKMAK

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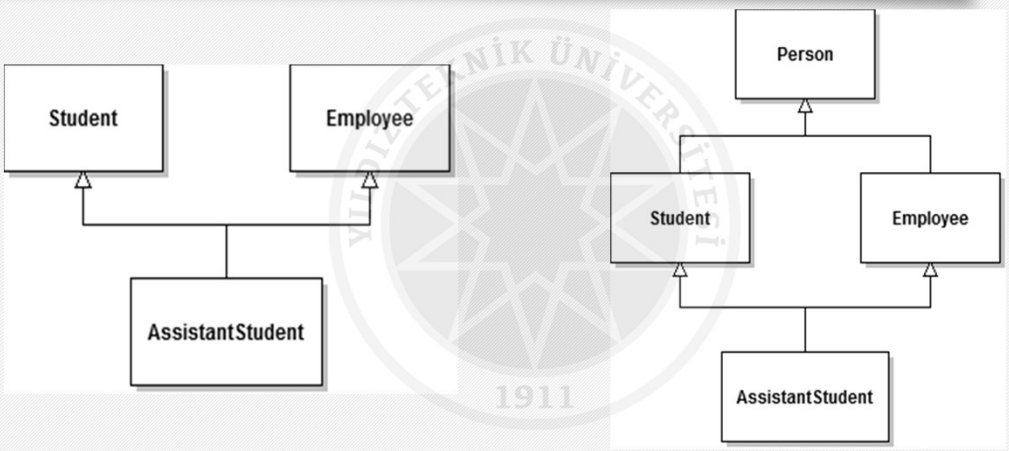
Multiple Inheritance



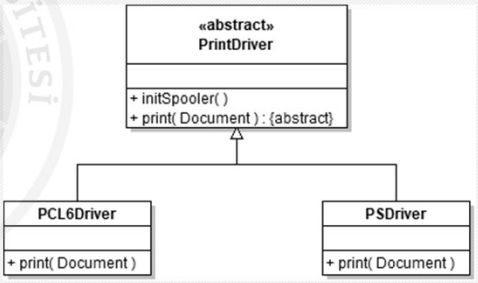
Abstract Classes

- An abstract class is such a class that it is used as a base class and it represents a template for its regular sub classes.
  - If a class is abstract, we identify it with the keyword abstract.
- It is forbidden to create instances of an abstract class.
- Abstract classes can have member fields, just like the concrete classes.
- Abstract classes can have both concrete and abstract member methods.
  - An abstract method has only definition together with the keyword abstract, it does not have a body.

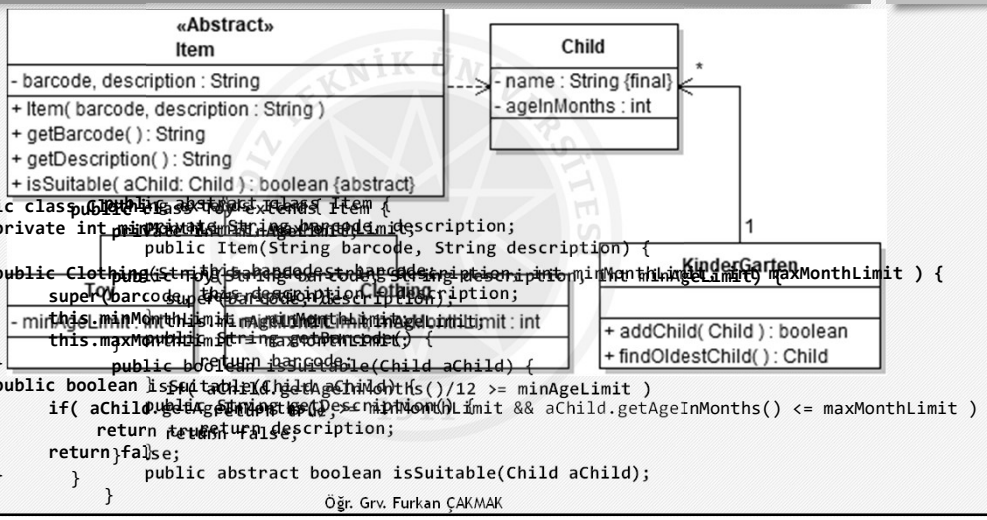
Abstract Classes (Con't)

- When do we need abstract classes?
- You can mark the abstract classes in UML class schemas in italics or by adding the <<Abstract>> stereotype.
  - <<…>>: This is called a stereotype.

```
public abstract class PrintDriver {
    public void initSpooler( ) {
    /* necessary codes*/
     }
     public abstract void print( Document doc );
}
public class PCL6Driver extends PrintDriver {
    public void print(Document doc) {
    //necessary code is inserted here
     }
}
```

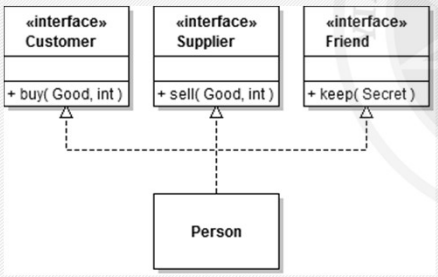


Abstract Classes: Example



Interfaces

- Interfaces can be thought as abstract classes **without members.**
  - **If you wish, you may add "public final static" member fields only.**
- An interface is a named collection of methods.
- UML representation and source code of an example:



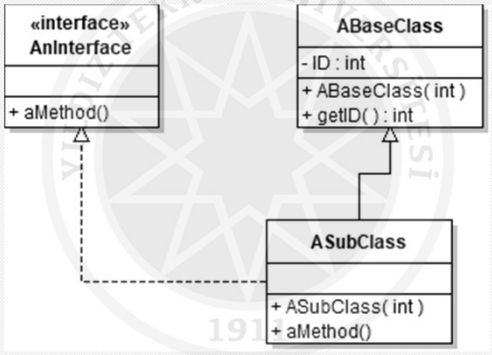

```
public interface Customer {
    public void buy( Good aGood, int quantity );
}
public interface Supplier {
    public void sell( Good aGood, int quantity );
}
public interface Friend {
    public void keep( Secret aSecret );
}
public class Person implements Customer,
        Supplier, Friend {
    public void buy( Good aGood, int quantity ) {
        //related code
    }
    public void sell (Good aGood, int quantity ) {
        // related code
    }
   public void keep( Secret aSecret ) {
        // related code
    }
}
```


Interfaces (Con't)

- We use interfaces …
  - in order to group responsibilities of entities,
  - in order to give objects multiple views,
  - instead of inheritance,
    - Because inheritance is a "heavy weight" relation that should be used only when it is absolutely necessary.
  - instead of multiple inheritance.
- Rules related to interfaces:
  - A class should code the bodies of all the methods of the implemented interfaces.
  - Regular member fields cannot be defined in interfaces. Interfaces can only have "public final static" member fields.
  - Only public methods can be defined in interfaces.
  - Interfaces cannot have constructors.
  - A class can implement multiple interfaces.
  - Suggestion: Begin naming interfaces with I (capital i).

Interfaces (Con't)

- Interface implementation and inheritance can be used together when needed:



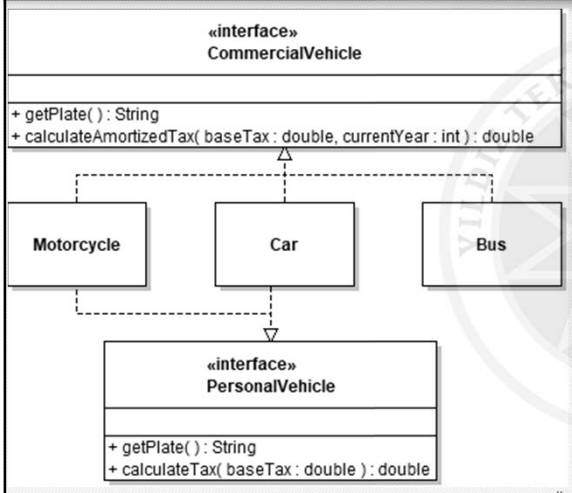

```
public class ASubClass extends ABaseClass implements AnInterface {
    // it should be easy to code the rest for you
}
```


DESIGNING AND CODING INTERFACES

- Consider the following requirement about calculating the taxes of vehicles:
  - Taxation of commercial and personal vehicles is different.
  - Motorcycles, cars and buses can be registered as commercial vehicles.
  - Only motorcycles and cars can be registered as personal vehicles .
  - Only taxes of commercial vehicles can be amortized.
  - Commercial or not, calculation of the tax of different vehicles (car, bus, etc.) are very different.
- How can we model this requirement?

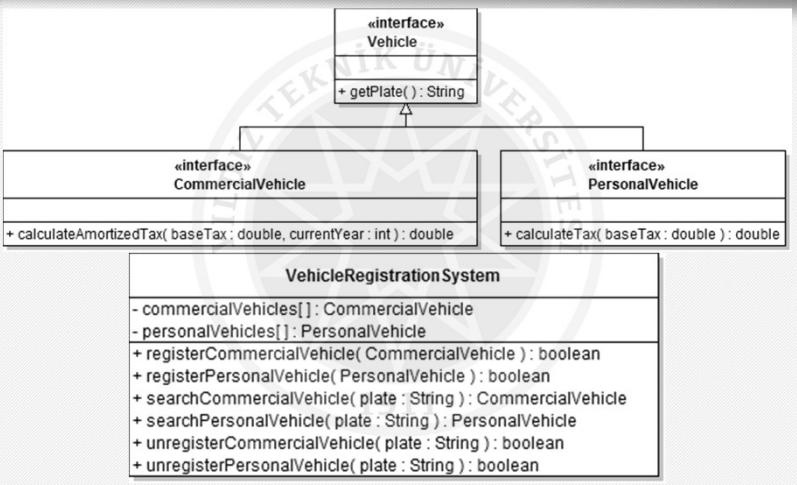
- Hint: If the tax calculation for different vehicles were similar (i.e. parametrized), using one abstract base class instead of interfaces would be a better choice.
- PS: We will code a year limit for maximum amortizement in the CommercialVechile interface but VioletUML doesn't let us draw this in here.

DESIGNING AND CODING INTERFACES (CON'T)




```
public interface CommercialVehicle {
    public final static int yearLimit = 10;
    public String getPlate();
    public double calculateAmortizedTax(double
        baseTax, int currentYear );
}
public interface PersonalVehicle {
    public String getPlate();
    public double calculateTax( double baseTax);
}
```


DESIGNING AND CODING INTERFACES (CON'T)



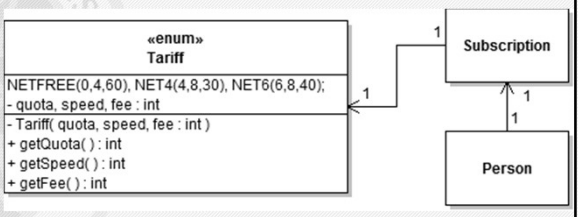
PRIMITIVE ENUMERATIONS and ENUM CLASSES


```
public enum Size {
    SMALL, MEDIUM, LARGE, EXTRA_LARGE;
}

Size s = Size.MEDIUM;
```

```
    public enum Tariff {
        NETFREE(0,4,60), NET4(4,8,30), NET6(6,8,40);
        private int quota, speed, fee;
        private Tariff( int quota, int speed, int fee ) {
            this.quota = quota; this.speed = speed; this.fee = fee;
        }
        public int getQuota() { return quota; }
        public int getSpeed() { return speed; }
        public int getFee() { return fee; }
    }

    public class Test {
        public static void main(String[] args) {
            Tariff tariff4 = Tariff.NET4;
            Person yunus = new Person("Yunus Emre");
            yunus.subscribeTo(tariff4);
            Person berkin = new Person("Berkin Gülay");
            berkin.subscribeTo(Tariff.NETFREE);
            System.out.println(yunus);
            System.out.println(berkin);
        }
    }
```



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Nesneye Yönelik Programlama BLM2012

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EXCEPTION HANDLING

- Some sources of error are:
  - Bugs in JVM
  - Wrong input by the user
  - Buggy code written by us
  - Acts of God
    - A lone and humble programmer cannot control:
      - every aspect of Internet traffic,
      - file access rights,
      - etc.
    - But we should be aware of them and deal with them!
- There are multiple ways of dealing with errors.
  - Boolean returns
  - Form components with error checking mechanisms
  - Exception handling.
- Exception handling is a form of error trapping.

EXCEPTION HANDLING

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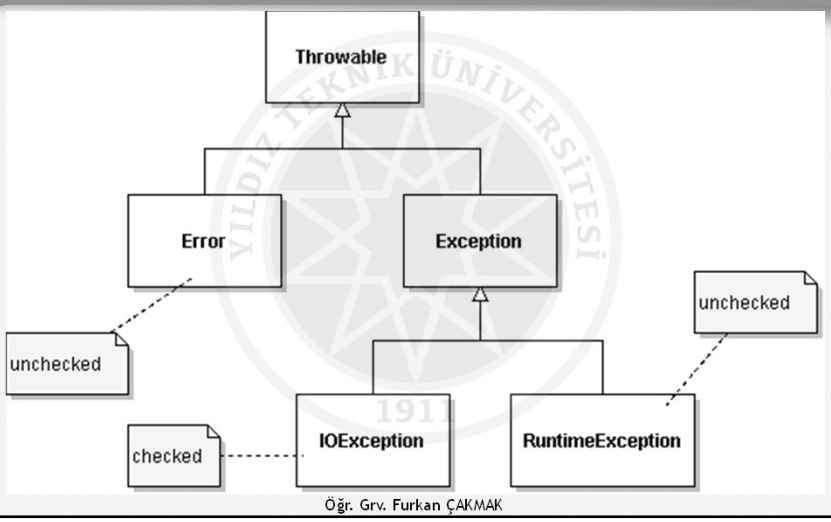

EXCEPTION HANDLING

- java.lang.Error:
  - indicates serious problems that a reasonable application should not try to catch
    - Internal JVM bugs, etc.
    - java.lang.UnsupportedClassVersionError: Can happen when you move your code between different versions of Eclipse/IDE.
- java.lang.RuntimeException:
  - This is mostly caused by our buggy code
    - java.lang.NullPointerException: We have tried to use an uninitialized object
    - java.lang.IndexOutOfBoundsException: We have tried to access a non-existent member of an array.
    - etc.
- java.io.IOException:
  - Something went wrong during a file operation or a network operation.
  - These operations are always risky, so we must have an alternate plan in case of something goes wrong.
    - If having an alternate plan is a must, than the exception is determined as checked.

EXCEPTION HANDLING

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- Handling checked exceptions is done by coding a try - catch block.

```
try {
    /* error-prone methods */;
}
catch( AnException e ) {
    /* Dealing with error */
}
```

- A programmer may opt to not handle a checked exception.
  - However, someone will eventually handle it!

```
aMethod(…) throws AnException {
    /* error-prone methods */
}
```

EXCEPTION HANDLING

- It is possible to handle multiple exceptions as well:

```
try {
    /* error-prone methods */;
}
catch( AnException e ) {
    /* Dealing with error */
}
catch( AnotherException e ) {
    /* Dealing with error */
}
```


EXCEPTION HANDLING

- What should I do in a catch block?
  - Inform the user about the error with the e.printStackTrace( ) method.
  - Log this error
- If this is a very serious error, you may release some resources and make a "clean exit" in the finally block.
  - Scopes of the try block and the finally block are different. Therefore you cannot access the temporary variables/objects defined in the try block from the finally block. Plan your "clean exit" accordingly.
  - The finally block executes whether an exception is thrown or not.

```
try {
    /* error-prone methods */;
}
catch( AnException e ) {
    /* Dealing with error */
}
catch( AnotherException e ) {
    /* Dealing with error */
}
finally {
    /* make a clean exit */
}
```

EXCEPTION HANDLING


```
public class ExceptionExample01 {
    MyScreenRenderer graphics;
    MyCADfile myFile;
    //Other methods of this class are omitted
    public void parseMyCADfile( String fileName ) {
        try {
         graphics = new MyScreenRenderer();
         myFile = openFile( fileName );
         MyFigure figs[ ] = myFile.readFromFile( );
         drawFigures( figs );
         myFile.close();
        }
        catch( IOException e ) {
         System.out.println("An IO exception has occurred"+
          " while opening or reading from file "+fileName+":"
          + e.toString( ) );
         e.printStackTrace( );
         System.exit(1); //Multithreaded, allows finally to be run
        }
        finally {
         graphics.releaseSources();
        }
    }
}
```


EXCEPTION HANDLING

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- You can create your own Exception classes by :
  - inheriting from IOException if you want your exception to be a checked one,
  - inheriting from RuntimeException if you want an unchecked one.

```
public class MyFileFormatException extends IOException {
    public MyFileFormatException( ) {
        super( );
    } //was required in JDK versions older than 5
    public MyFileFormatException( String errorMessage ) {
        super( errorMessage );
        /* Other things to do (optional) */
    } //necessary for informing the user and/or programmer
}
```

EXCEPTION HANDLING

- Throwing an exception:
  - If something terrible may happen during your code, you can throw an exception

```
public class AProgram {
    public void processFile ( ) throws MyFileFormatException{
        some_statements();
        if( an_unexpected_situation )
            throw new MyFileFormatException("... happened");
    }
}
```


EXCEPTION HANDLING - EXAMPLE


```
package nyp09;
import java.io.IOException;
/* @home: Check the needed additions
 * if we had extended this exception
 * from java.lang.RuntimeException
 */
@SuppressWarnings("serial")
public class ImpossibleInfo extends IOException {
       public ImpossibleInfo( String errorMessage ) {
           super(errorMessage);
       }
   }
}
```

EXCEPTION HANDLING – EXAMPLE CON'T


```
package nyp09;
public class Person {
    private String name;
    private int age;

    public Person( String name ) { this.name = name; }
    public String getName( ) { return name; }
    public int getAge( ) { return age; }
    public String toString() {
        return getName() + " " + getAge( );
    }
    public void setAge( int age ) throws ImpossibleInfo {
        if( age < 0 || age > 150 )
           throw new ImpossibleInfo("Impossible age: "+age);
        this.age = age;
    }
}
```


EXCEPTION HANDLING – EXAMPLE CON'T

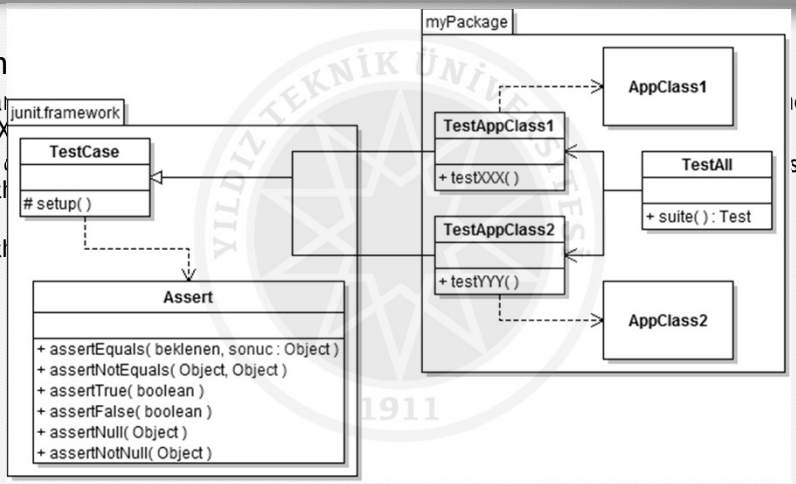

```
package nyp09;
import java.util.*;
public class TestExceptions {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.print("Enter person's name: ");
        String name = in.nextLine();
        Person insan = new Person(name);
        try {
            System.out.print("Enter age: ");
            int age = in.nextInt();
            insan.setAge(age);
            System.out.println(insan);
        }
        catch (ImpossibleInfo e) {
            e.printStackTrace();
        }
        finally {
            in.close();
        }
    }
}
```

UNIT TESTING – ABOUT UNIT TESTING WITH TOOL SUPPORT

- We have used a separate class having a main method to test our code so far.
  - We have tested the responsibilities of our smallest coding unit, namely the classes we have coded.
  - This is called **'Unit Testing'** in literature.
- Notice that we had to use extensive if-else cases to determine whether a test case was successful or not.
  - Then we had to analyze all the printouts why and where a test case has failed.
- We need to be able to design, execute and analyze the results of our tests.
  - Having a tool for this purpose helps a lot.
- A widely used unit testing tool named **jUnit** can help us.

UNIT TESTING WITH JUNIT

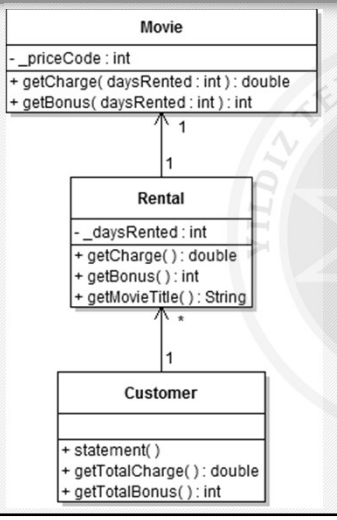
- Preparin
  - Prepa ethods such as testXX
    - You stAll.suite( )
    - The

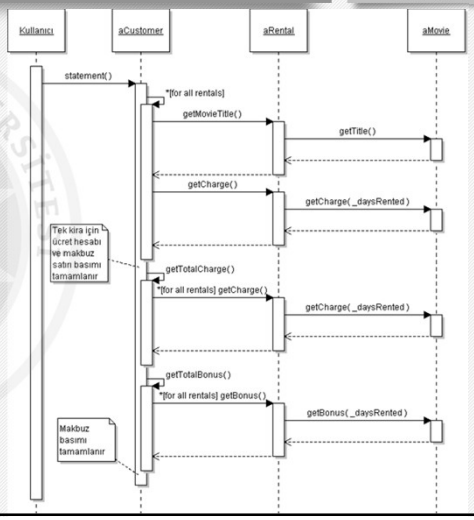


UNIT TESTING

- Preparing test cases with jUnit version 4.X:
  - In addition to preserving backwards compatibility with v3, jUnit v4 adds annotation support:
    - Test classes are no longer needed to inherit from the TestCase class.
    - Test case methods' names no longer need to start with the test word, it is enough to annotate them by using the @test annotation.
      - The setup method is annotated by @before.
      - `@Before`
      - `public void setUp() { /*Preparations*/ }`
      - `@Test`
      - `public void testSomething() { /*Do test*/ }`
    - Exception support is now possible, too: You can test whether a necessary exception is thrown or not, without halting the tests.
      - `@Test(expected=SomeException.class)`
      - `public void testTheException() throws Exception {`
      - `doSomethingThatCreatesTheException();`
      - `}`

UNIT TESTING -
Let's code unit test cases for a simple movie rental example





UNIT TESTING -
Let's code unit test cases for a simple movie rental example


```
package unitTestingByFowler;
import junit.framework.TestCase;
public class TestCustomer extends TestCase {
   private Customer yunus;
   private Movie matrix, monster, surrogate, terminator;
   protected void setUp() {
     yunus = new Customer("Yunus Emre Selçuk");
     matrix = new Movie("The Matrix",Movie.REGULAR);
     monster = new Movie("Monsters, Inc.",Movie.CHILDRENS);
     surrogate = new Movie("Surrogates", Movie.NEW_RELEASE);
     terminator = new Movie("Terminator Salvation",Movie.NEW_RELEASE);
   }
   public void testGetName( ) {
     String sonuc = yunus.getName( );
     assertEquals("Yunus Emre Selçuk",sonuc);
   }
   public void testStatementWhenEmpty( ) {
     String sonuc = yunus.statement();
     String beklenen = "Rental Record for Yunus Emre Selçuk\n";
     beklenen += "Amount owed is 0.0\n";
     beklenen += "You earned 0 frequent renter points";
     assertEquals(beklenen, sonuc);
   }
```

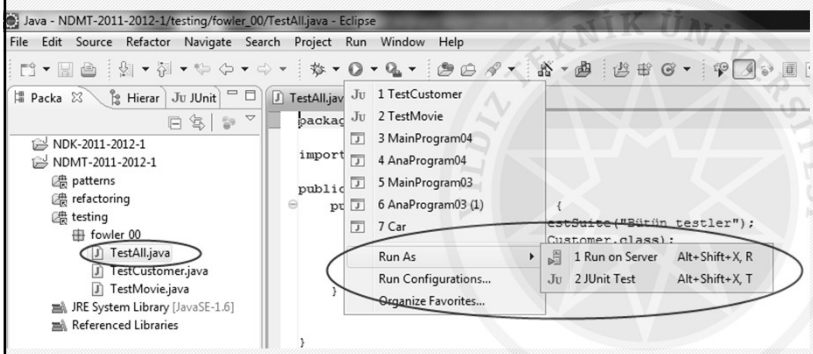

UNIT TESTING -
Let's code unit test cases for a simple movie rental example

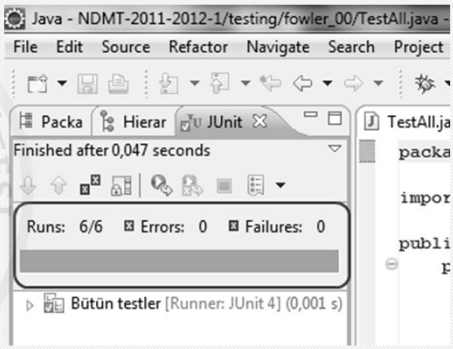

```
public void testStatementWithMoviesLongRent( ) {
  yunus.addRental( new Rental(matrix, 3) );
  yunus.addRental( new Rental(monster, 4) );
  yunus.addRental( new Rental(surrogate, 2) );
  String sonuc = yunus.statement();
  String beklenen = "Rental Record for Yunus Emre Selçuk\n";
  beklenen += "\tThe Matrix\t3.5\n";
  beklenen += "\tMonsters, Inc.\t3.0\n";
  beklenen += "\tSurrogates\t6.0\n";
  beklenen += "Amount owed is 12.5\n";
  beklenen += "You earned 4 frequent renter points";
  assertEquals(beklenen, sonuc);
}
public void testStatementWithMoviesShortRent( ) {
  yunus.addRental( new Rental(matrix, 2) );
  yunus.addRental( new Rental(monster, 3) );
  yunus.addRental( new Rental(surrogate, 1) );
  String sonuc = yunus.statement();
  String beklenen = "Rental Record for Yunus Emre Selçuk\n";
  beklenen += "\tThe Matrix\t2.0\n";
  beklenen += "\tMonsters, Inc.\t1.5\n";
  beklenen += "\tSurrogates\t3.0\n";
  beklenen += "Amount owed is 6.5\n";
  beklenen += "You earned 3 frequent renter points";
  assertEquals(beklenen, sonuc);
}
```

UNIT TESTING -
Let's code unit test cases for a simple movie rental example


```
 public void testNewReleaseRentalBonus( ) {
     yunus.addRental( new Rental(surrogate, 2) );
     yunus.addRental( new Rental(terminator, 1) );
     String sonuc = yunus.statement();
     String beklenen = "Rental Record for Yunus Emre Selçuk\n";
     beklenen += "\tSurrogates\t6.0\n";
     beklenen += "\tTerminator Salvation\t3.0\n";
     beklenen += "Amount owed is 9.0\n";
     beklenen += "You earned 3 frequent renter points";
     assertEquals(beklenen, sonuc);
    }
}
package unitTestingByFowler;
import junit.framework.*;
public class TestAll {
   public static Test suite( ) {
      TestSuite suite = new TestSuite("Bütün testler");
      suite.addTestSuite(TestCustomer.class);
      suite.addTestSuite(TestMovie.class);
      return suite;
   }
}
```


UNIT TESTING -
Let's code unit test cases for a simple movie rental example





UNIT TEST with JUNIT

- Disadvantages of manual testing:
  - Our test code is one overly long function that is harder to examine.
    - We may forget what we are testing about.
  - We may need to manually search any "Problem" string in a long and verbose output text.
  - Our problem cases so far did not tell what especially gone wrong.
- We can alleviate these problem by automated test execution and evaluation.
  - Our test code becomes more modular
  - We have a green bar instead! Moreover, assertEquals compares its two parameters and highlight the first difference between them, especially they are String instances.

Sabırla Dinlediğiniz İçin Teşekkürler