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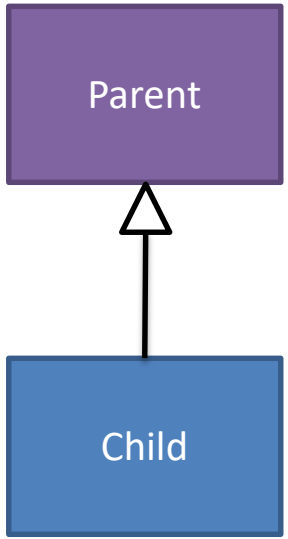
Inheritance and Polymorphism Part 01

Inheritance

- Inheritance allows Data and Methods to be *inherited / absorbed* from one class into another
- In Java, this occurs between two classes
  - Subclass (Child): The class inheriting from another
  - Superclass (Parent): The class that is being inherited
- This is great for *extending* the properties and functionality of one class into another
  - The subclass becomes a more specific version of the superclass
  - The superclass is a more general version of the subclass
  - Creates an “is a” relationship

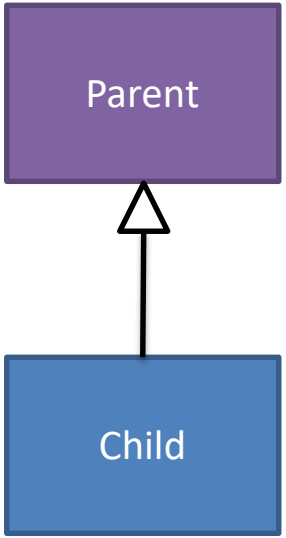
Inheritance Concept



Inheritance

- Private properties and methods are not inherited from the superclass
- Instance variables from the superclass must be accessed through their accessors
- Instance variables from the superclass must be modified through their mutators

Inheritance Concept



Inheritance

- The reserved word “extends” is used to inherit from one class into another
- The reserved word “super” is used to call methods from the superclass
  - To call a superclass’ constructor it should use “super()” or “super(<<parameters>>)”
  - To call any other superclass’ methods user “super.<<method id>>(<<parameters>>)”
  - To access properties in the superclass use “super.<<accessor>>”
  - To modify properties in the superclass use “super.<<mutator>>”

Inheriting a Class Syntax

```
public class <<subclass id>> extends <<superclass id>>
{
      //Body of the class
}
```

Example

```
public class Student extends Person
{

}
```

Inheritance

- In Java, a subclass does not inherit constructors from the superclass
- The reserved word “super” should used to call the superclass’ constructor
  - Generally, it should be the first call in a subclass’ constructor
  - “super()” is the call to the superclass’ default constructor
  - “super(<<SC’s params>>)” is the call to the superclass’ (SC’s) parameterized constructor
- The subclass’ parameterized constructor should also include the superclass’ properties as parameters

Inheritance Constructor Syntax

```
public <<subclass id>>()//Default Constructor
{
      super();//Call to super class’ default constructor
      …
}
```

Example

```
public Student()
{
      super();//Call to Person’s default constructor
      …
}
```

Inheritance

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Inheritance Constructor Syntax

```
public <<subclass id>>(<<SC’s params>>, <<subclass’ params>>)
{
        //Call to super class’ default constructor
        super(<<SC’s params>>);
        …
}
```

Example

```
public Student(String aN, int anID)
{
        super(aN);//Call to Person’s param constructor
        …
}
```

Overriding Methods

- Overriding a method is when a subclass has the same *signature* or *definition* of a method in the superclass
  - Different from Overloading Methods
- A method from the superclass can be called from the subclass by using "super.<<method id>>"
- This can be useful when overriding the ".equals()" and ".toString()" method
- The reserved word "final" can be used so a method or class CANNOT be overridden or extended

Inheritance "toString()" Syntax

```
public String toString()
{
      return super.toString() + <<other properties>>
}
```

Example

```
//Student's toString method
public String toString()
{
      return super.toString() + "ID: "+this.id;
}
//super.toString() is a call to Person's toString
//method
```

Overriding Methods

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Inheritance "equals()" Syntax

```
public boolean equals(<<AI>>)
{
      return super.equals(<<AI>>) &&
                  <<property checks>>
}
```

Example

```
//Student's equals method
public boolean equals(Student aS)
{
      return aS != null && super.equals(aS) &&
            this.id == aS.getID();
}
//super.equals() is a call to Person's equals //method
```

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Example

Personnel System

- Problem: We must keep track of important information about people at a University
- Different types include:
  - Undergraduate Students
  - Graduate Students
  - Faculty
  - Staff
- Undergraduate Information
  - Name
  - Student ID
  - Level
- Graduate Information
  - Name
  - Student ID
  - Advisor's Name
- Faculty Information
  - Name
  - Salary
  - Courses
- Staff Information
  - Name
  - Salary
  - Supervisor
- Should be able to:
  - Add new people
  - Remove people
  - View all people in the system
- Clear and Easy-to-Use Frontend

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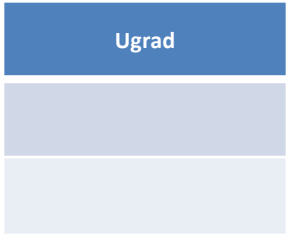

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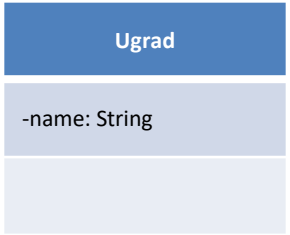

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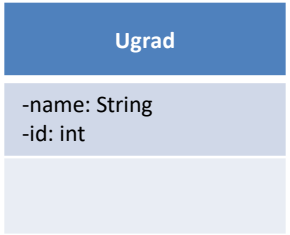

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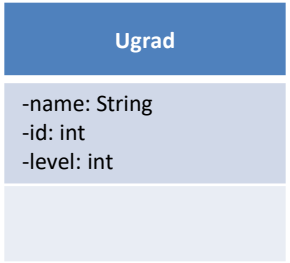

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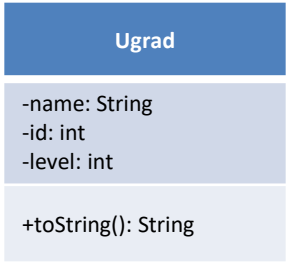

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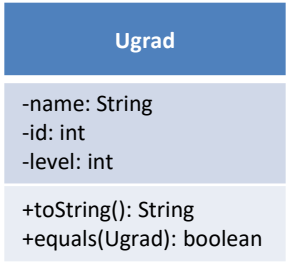

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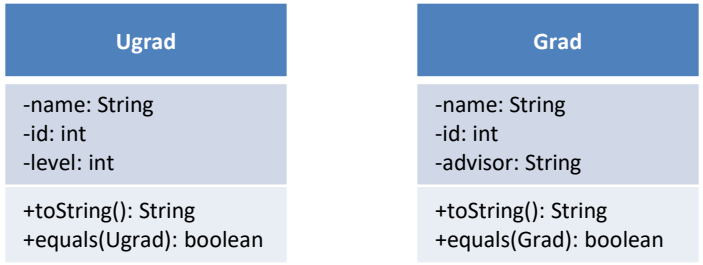

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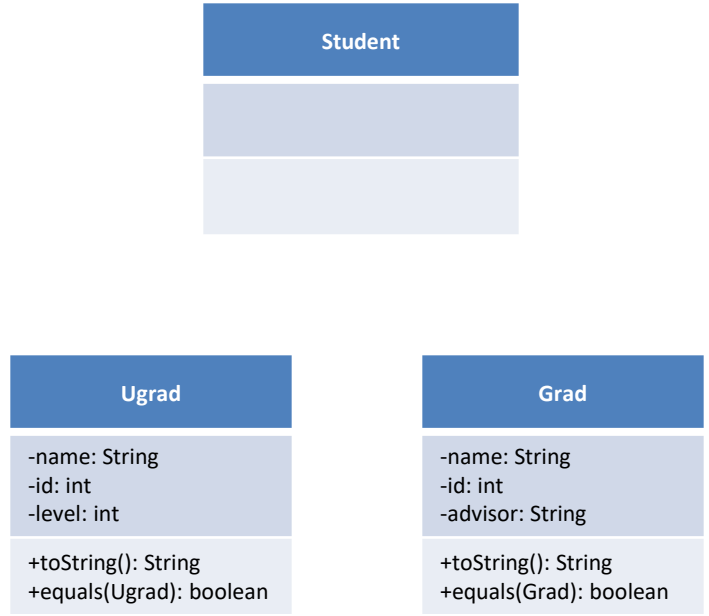

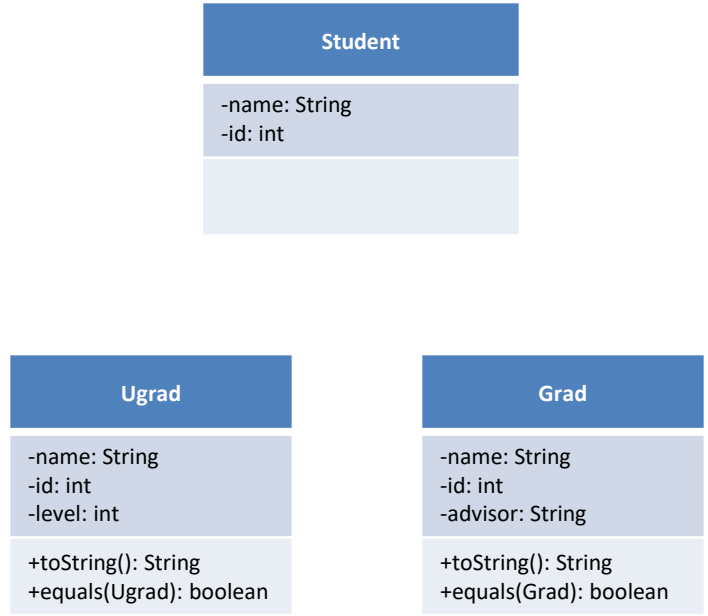

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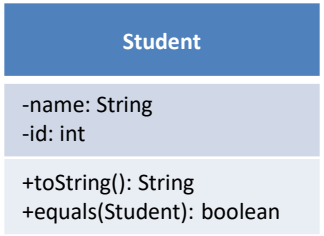

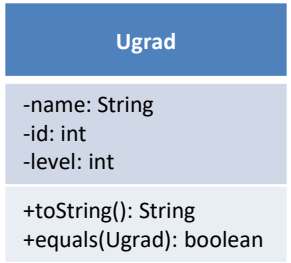

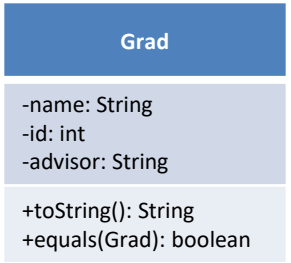

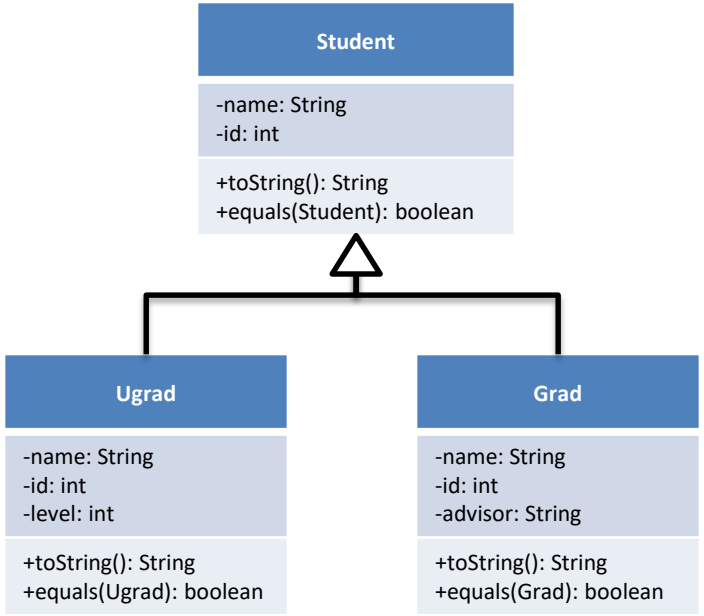

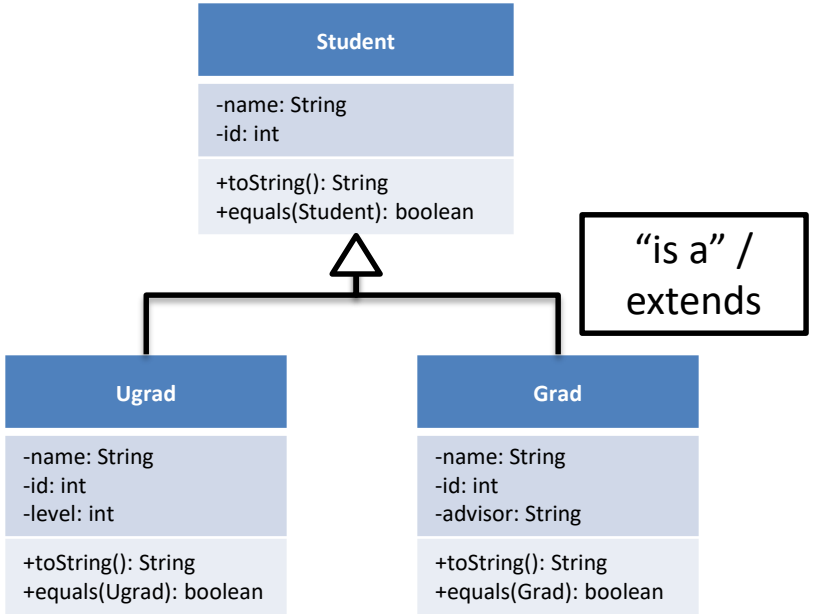

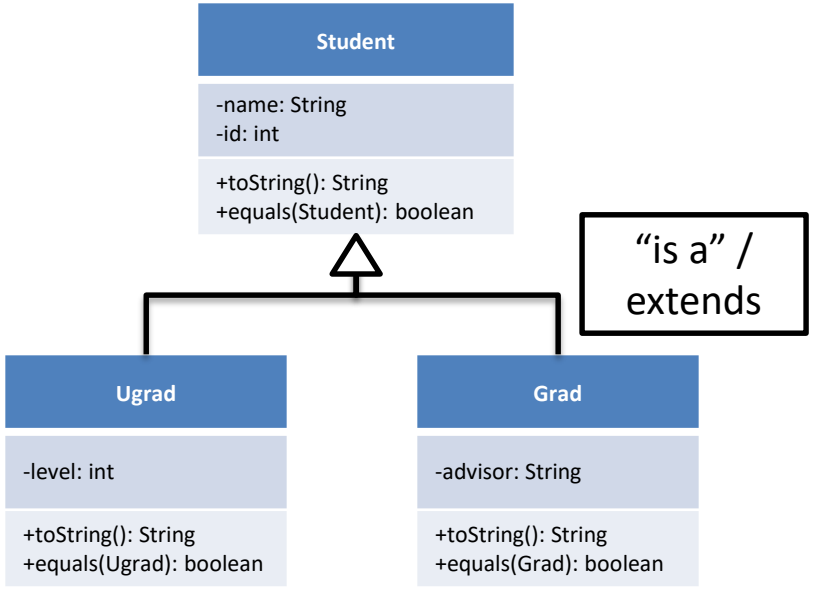

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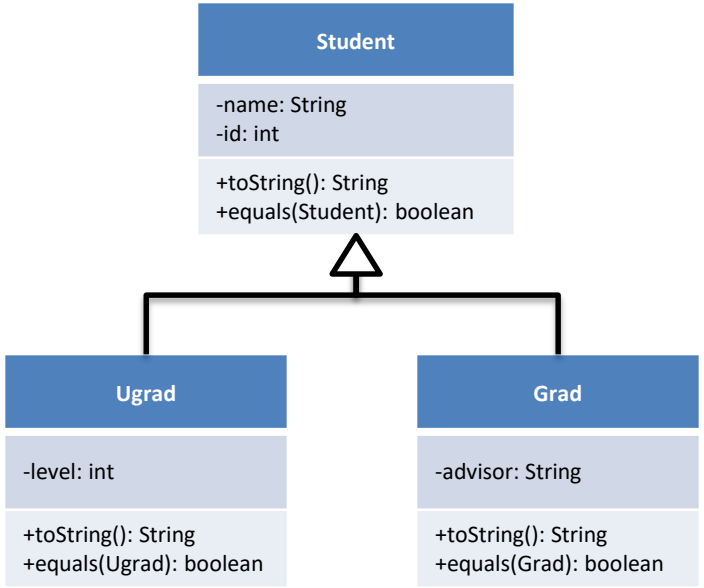

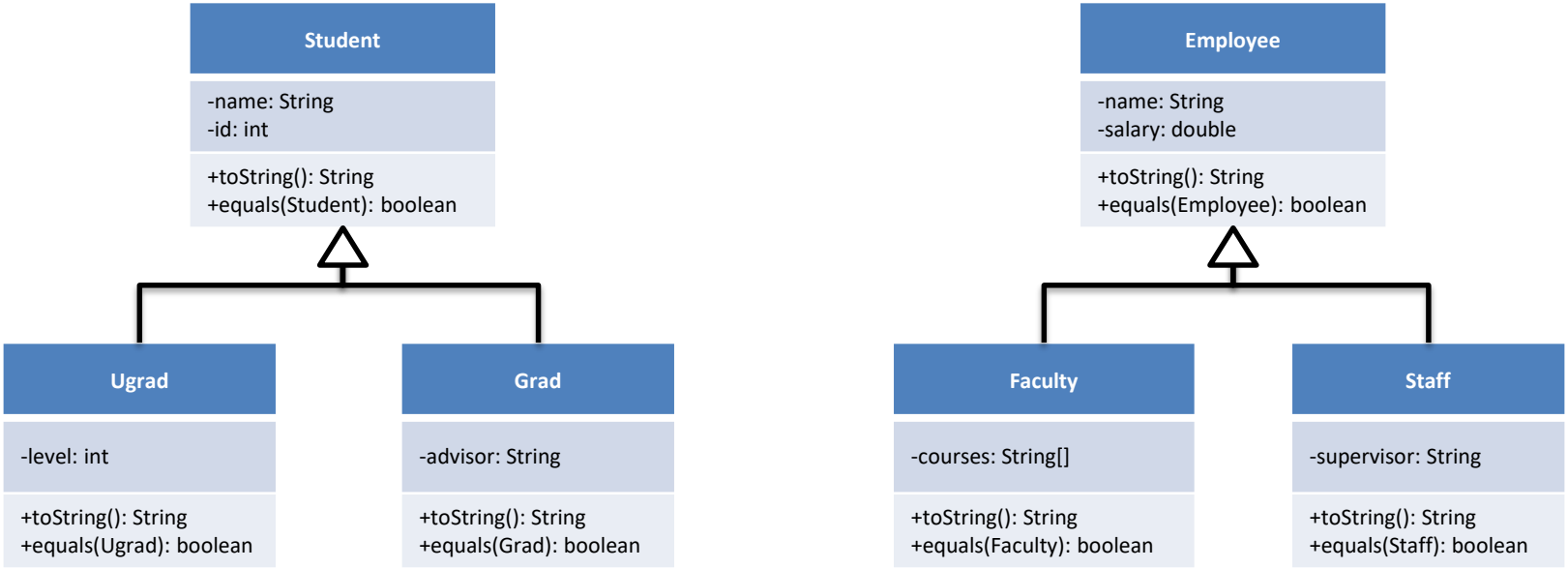

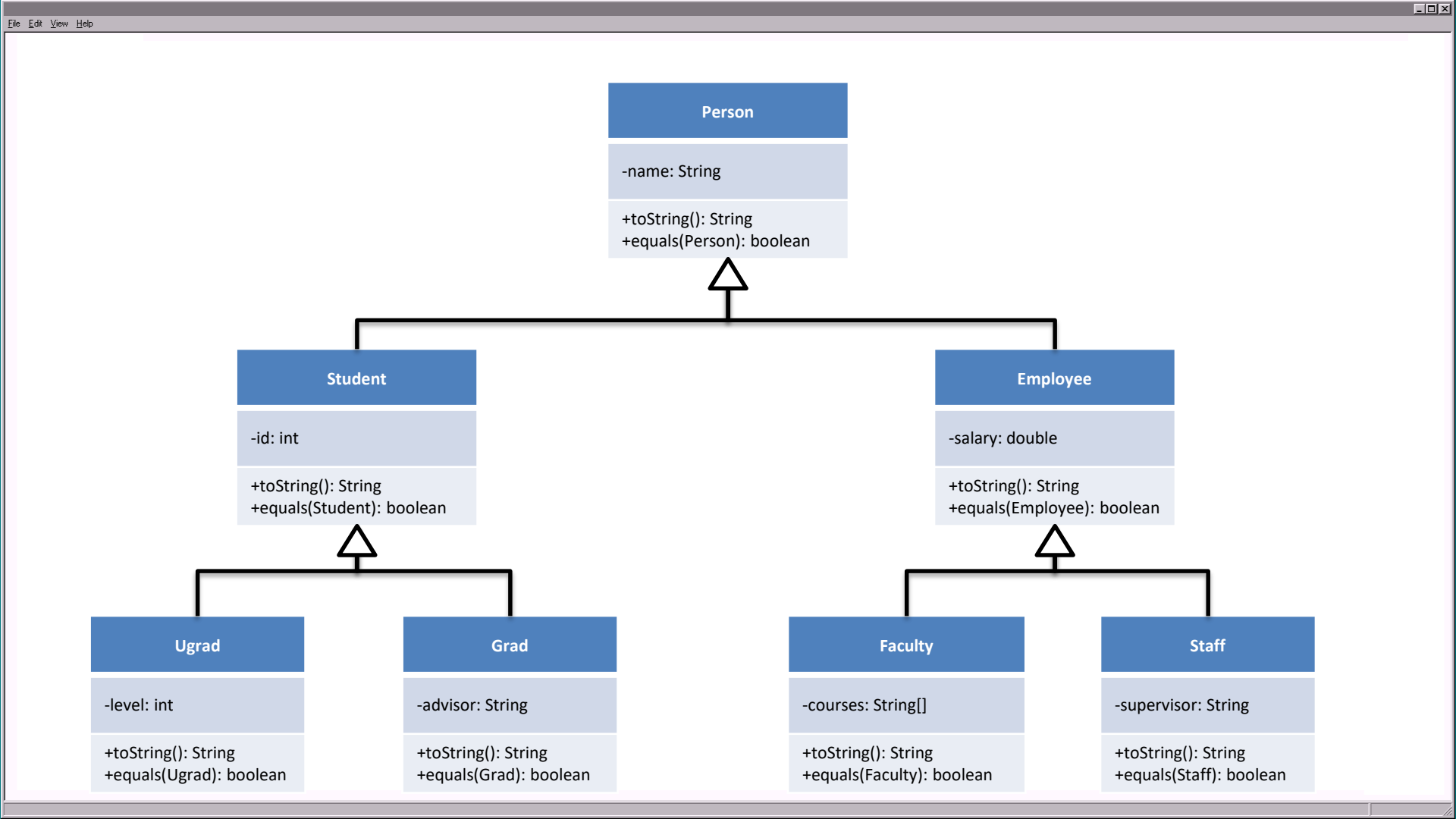
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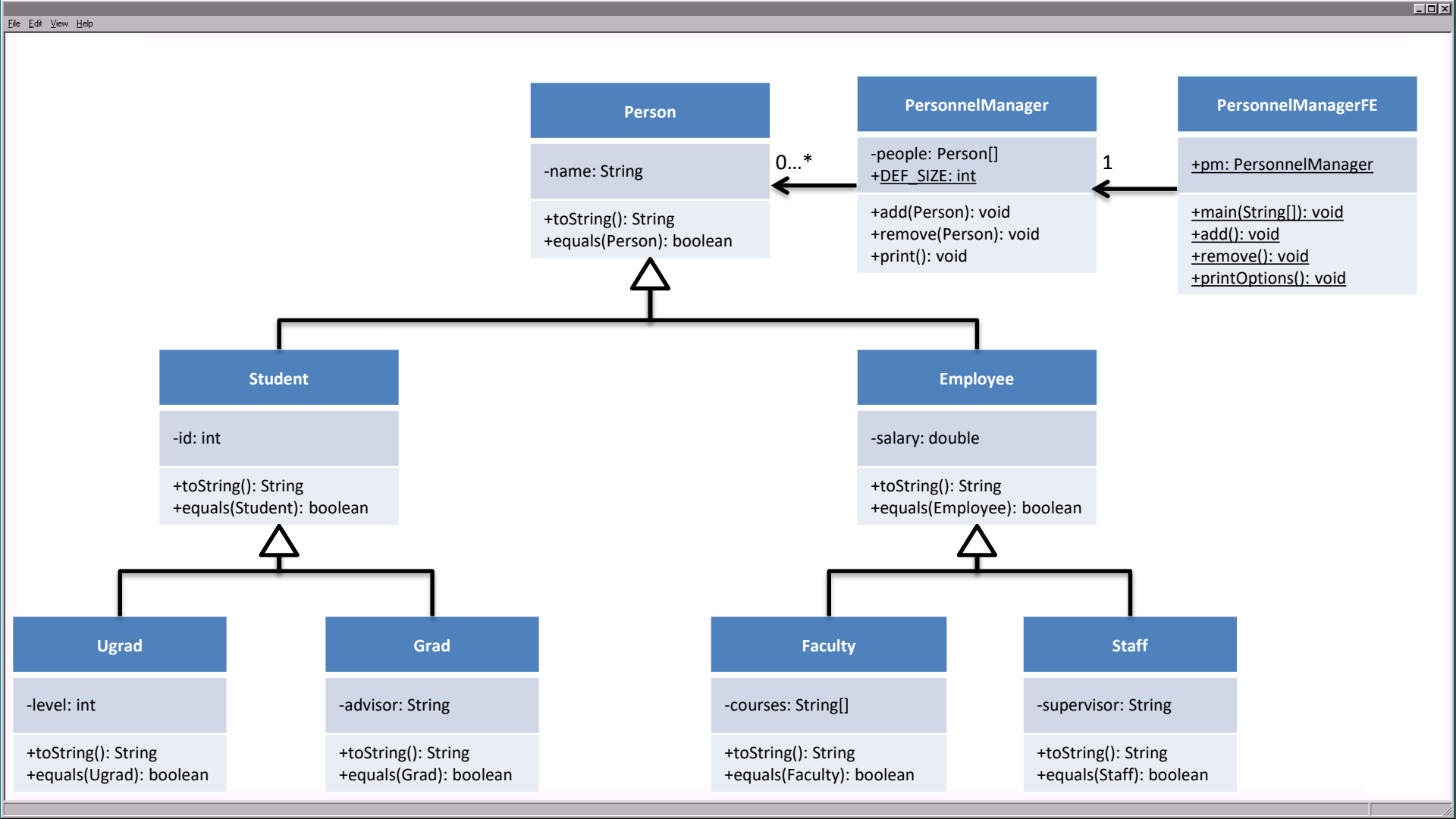
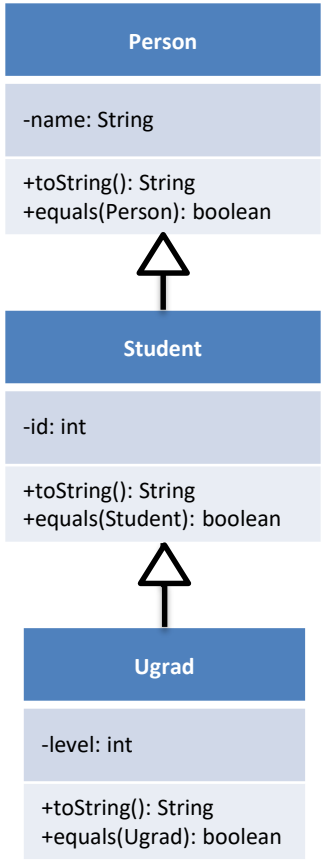
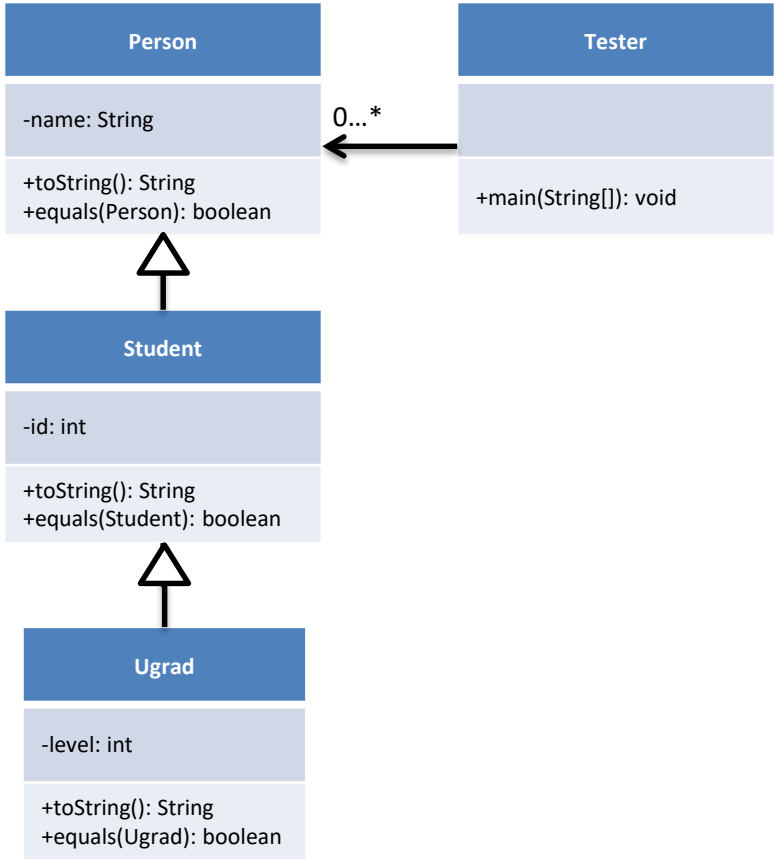
Person
-name: String
+toString(): String
+equals(Person): boolean
Student
-id: int
+toString(): String
+equals(Student): boolean
Employee
-salary: double
+toString(): String
+equals(Employee): boolean
Ugrad
-level: int
+toString(): String
+equals(Ugrad): boolean
Grad
-advisor: String
+toString(): String
+equals(Grad): boolean
Faculty
-courses: String[]
+toString(): String
+equals(Faculty): boolean
Staff
-supervisor: String
+toString(): String
+equals(Staff): boolean


File Edit View Help
Person
-name: String
+toString(): String
+equals(Person): boolean
0...*
PersonnelManager
-people: Person[]
+DEF_SIZE: int
+add(Person): void
+remove(Person): void
+print(): void
1
PersonnelManagerFE
+pm: PersonnelManager
+main(String[]): void
+add(): void
+remove(): void
+printOptions(): void
Student
-id: int
+toString(): String
+equals(Student): boolean
Employee
-salary: double
+toString(): String
+equals(Employee): boolean
Ugrad
-level: int
+toString(): String
+equals(Ugrad): boolean
Grad
-advisor: String
+toString(): String
+equals(Grad): boolean
Faculty
-courses: String[]
+toString(): String
+equals(Faculty): boolean
Staff
-supervisor: String
+toString(): String
+equals(Staff): boolean


Person
-name: String
+toString(): String
+equals(Person): boolean
Student
-id: int
+toString(): String
+equals(Student): boolean
Ugrad
-level: int
+toString(): String
+equals(Ugrad): boolean



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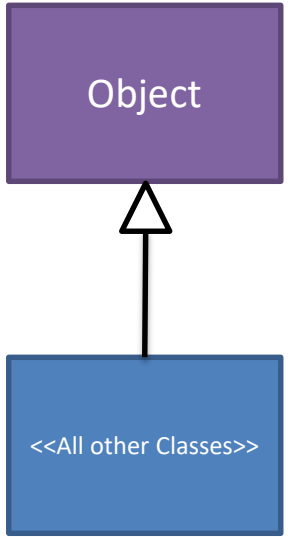
Example

Inheritance

- Every class in Java extends from the type “Object”
- Many methods are already assumed to be in each class
  - toString()
  - equals()
- We override the “toString()” and “equals()” methods to define our own specific version
  - The “toString()” method is called every time a class’ id is an argument for “System.out.println()”

Inheritance Concept



Polymorphism

- "One becomes many"
- A superclass can be extended or implemented in many different ways
- A change to a superclass is reflected across all subclasses
- Allows substitution of one class for another as long as the class *is an* extension
  - This is how the "equals()" methods works for different types
- Made possible by *dynamic binding* aka *late binding*

Polymorphism Concept