UNIVERSITY OF TWENTE.

APPLICATION DEVELOPMENT

LECTURE 3: DESIGN A CLASS, USING OBJECTS AND METHODS, CONDITIONS AND LOOPS

```
class AppDev {

}
```

Part of SmartProducts

INTRODUCTION

APPLICATION DEVELOPMENT

- Design a class
- Using objects and methods
- Conditions and loops
- Assignment

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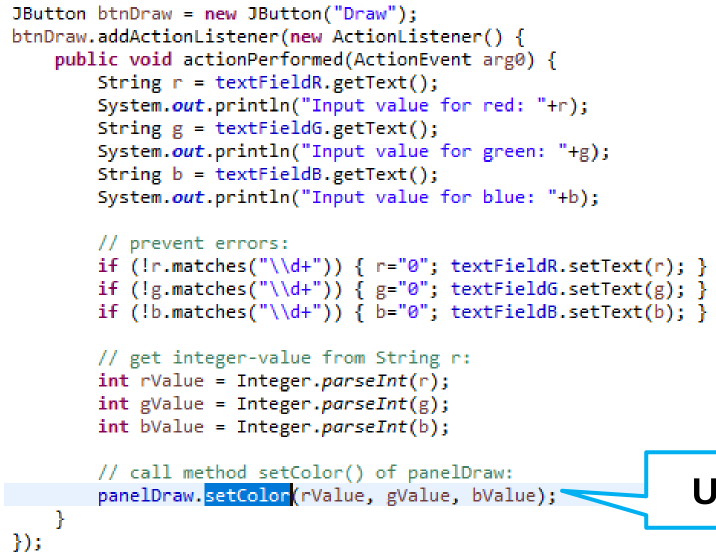
slides @ vanslooten.com/appdev

ASSIGNMENT 2

- Adding a variable and a method
- A method declaration (definition) and it's use (call)



```
JButton btnDraw = new JButton("Draw");
btnDraw.addActionListener(new ActionListener() {
    public void actionPerformed(ActionEvent arg0) {
        String r = textFieldR.getText();
        System.out.println("Input value for red: "+r);
        String g = textFieldG.getText();
        System.out.println("Input value for green: "+g);
        String b = textFieldB.getText();
        System.out.println("Input value for blue: "+b);

        // prevent errors:
        if (!r.matches("\\d+")) { r="0"; textFieldR.setText(r); }
        if (!g.matches("\\d+")) { g="0"; textFieldG.setText(g); }
        if (!b.matches("\\d+")) { b="0"; textFieldB.setText(b); }

        // get integer-value from String r:
        int rValue = Integer.parseInt(r);
        int gValue = Integer.parseInt(g);
        int bValue = Integer.parseInt(b);

        // call method setColor() of panelDraw:
        panelDraw.setColor(rValue, gValue, bValue);
    }
});
```

```
public class DrawingPanel extends JPanel {

  Color drawColor = Color.yellow;

  protected void paintComponent(Graphics g) {
    super.paintComponent(g);
         ...
  }

  public void setColor(int r, int g, int b) {
    drawColor = new Color(r % 256, g % 256, b % 256);
    // draw again because the color has been changed:
    repaint();
  }
```

Declaration

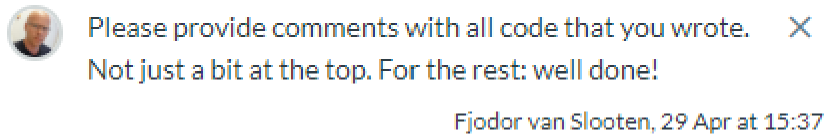
Use (call)

Find declaration? Select and press F3
(or right-click)

FEEDBACK & ASSIGNMENTS

Grade on Canvas: 1 = Pass, 0 = Fail

- Read the feedback on Canvas!



Please provide comments with all code that you wrote. Not just a bit at the top. For the rest: well done!

Fjodor van Slooten, 29 Apr at 15:37

- You *might* receive a request for an additional check:
- This does not 'mean' anything: it is just an extra check we do randomly with about 10% of the students

"You have been selected to give an additional live demo and/or answer questions via a video chat. On the next lecture day, please ask for this check. You must do this to pass the assignment!"

There is no time limit for this, but **we urge you to do it on the next lecture day**: otherwise you might have forgotten the meaning of code you wrote and fail the test.

- If we question the authenticity of your work, we might request a check also, but then the message will be different

DESIGN A CLASS
ANALYZE OBJECT (IN REAL WORLD)

Properties ↓

Position (x,y)
Diameter
Color

Ball

Actions/behavior ↓

Move
Bounce (change direction)
Draw

(methods)

What (is)? → Properties
What can … do? → Methods
How can … do? → (Pseudo) code (of methods)

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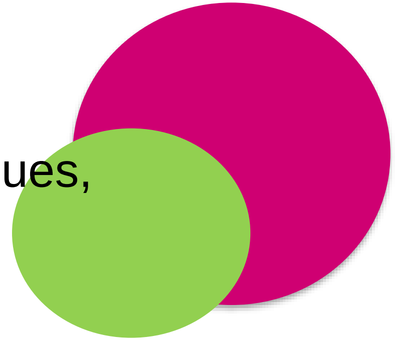
DESIGN A CLASS

DETAIL CLASS IN (PSEUDO) CODE

Pseudo code: incomplete code, human-readable

- Types of properties
- Methods: return values, parameters



```
public class Ball {
  // properties:
  int x, y; // position
  int diameter;
  Color color;

  // methods:
  public void move();
  public void bounce();
  public void draw(Graphics g);
}
```

Parameter **g**, of type **Graphics**, needed for drawing

Standard return value: **void** (=nothing), and modifier **public**

DESIGN A CLASS

DETAIL METHODS IN (PSEUDO) CODE

Pseudo code: incomplete code, human-readable

Next step: start coding

- For each method:
- Write steps in pseudo code
- If new variables/properties are needed, alter design

```
public void bounce() {
  reverse direction:
  dx = -dx
  dy = -dy
}
```

```
public void move() {
  increase position (x,y)
  // by what? introduce dx/dy? (delta x and y)
}
```

```
public void draw(Graphics g) {
  set color
  draw filled circle at position (x,y)
}
```

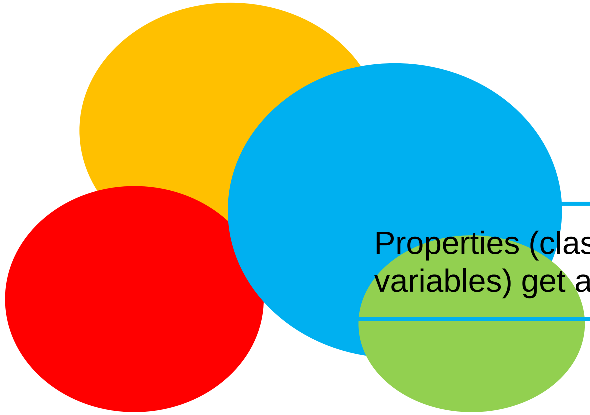
CREATE BALLS: NEW

b1 is a new object of type **Ball:** "b1 is a Ball"

```
Ball b1 = new Ball(10, Color.orange, 10, 20);
Ball b2 = new Ball(8,  Color.red,     5, 30);
Ball b3 = new Ball(15, Color.blue,   20, 25);
Ball b4 = new Ball(5,  Color.green,  30, 30);
```

Call to constructor

Parameters determine difference in properties



Properties (class variables) get a value

```
// constructor assigns properties:
public Ball(int d, Color c, int i, int j) {
  diameter = d;
  color = c;
  x = i;
  y = j;
}
```

Constructor: special method with same name as class and no return value

USING OBJECTS

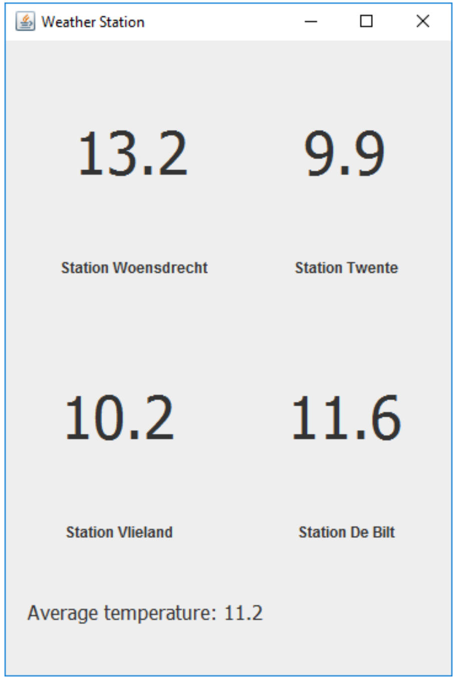
- Assignment: weather-panels, create a class once, use 4 times

```
panel = new TemperaturePanel(6340);

panel2 = new TemperaturePanel(6290);

panel3 = new TemperaturePanel(6260);

panel4 = new TemperaturePanel(6235);
```



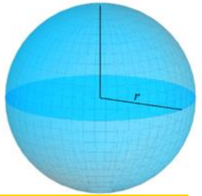
Average temperature: 11.2

METHODS: RETURN VALUE

Surface area [edit]

The surface area of a sphere is:

$$A = 4\pi r^2.$$



en.wikipedia.org/wiki/Sphere

Type of result: **double**

Parameter

```
public double calculateSurfaceArea(double r) {
   double A;
   A = 4 * Math.PI * Math.pow(r,2);
   return A;
}
```

Return the value (to caller)

Calculation

Use the method:

Parameter passed to method

```
double result = calculateSurfaceArea(10);
```

Call of the method

More info

‘CALL’ A METHOD

WITH TEXT AS A PARAMETER

Variable **temp** gets a value

‘Call’ method **readTemperature()** of object ***w***

“Dear weather station, please read the temperature for us”

```
String temp = w.readTemperature();

labelTemp.setText(temp);
```

“Show temperature in userinterface”

Call method **setText** to show String temp in a label

Variable **temp** is used as a parameter in a method-call

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CONDITIONS

IF …

Condition between (…)

```
int x = 3;
if (x == 3) {
   System.out.println("x must be 3");
}
```

(Conditional or Boolean) Operators

<	smaller?
<=	smaller or equal?
>	larger?
>=	larger or equal?
==	equal?
!=	not equal?

x=5	x gets value 5 (assignment)
x==5	does x equal 5 ?

CONDITIONS

IF … ELSE …

```
int age = 14;
int length = 110;

if (age < 10 && length > 110)
  System.out.println("You are a tall kid");
else if (age > 10 && length <= 110)
  System.out.println("Eat more bananas!");
else
  System.out.println("I guess you are Ok");
```

More info

Logical operators

&&	and
||	or
!	not

Use to build boolean expressions.
Result is *true* or *false*.

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CONDITIONS

SWITCH

```
switch(x) {
  case 1:
             soundbite = new File("cat.wav"); break;
  case 2:
             soundbite = new File("chicken.wav"); break;
  case 3:
             soundbite = new File("cow.wav"); break;
  case 4:
             soundbite = new File("dog.wav"); break;
  case 5:
             soundbite = new File("frog.wav"); break;
  default:
             soundbite = new File("bird.wav");
}
```

`default`: if none of the options complies

More info

REPEAT: LOOPS

WHILE …

More info

Condition between (…)

```
Dog rufus = new Dog();

int x = 0;
while (x < 3) {
  rufus.bark();
  x = x + 1;
}
```

How many times does rufus bark?

Condition depends on x!

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REPEAT: LOOPS

FOR …

Control variable

Condition

Step for control variable

More info

```
for (int l=0; l<4; l++) {
  System.out.println("Line "+l);
}
```

What is the output of these loops?

```
for (int l=0; l<8; l++) {
  for (int c=0; c<l; c++)
         System.out.print("#");
  System.out.println("");
}
```

increase a variable x by one: x++
same as: x = x + 1

FORMAT OUTPUT

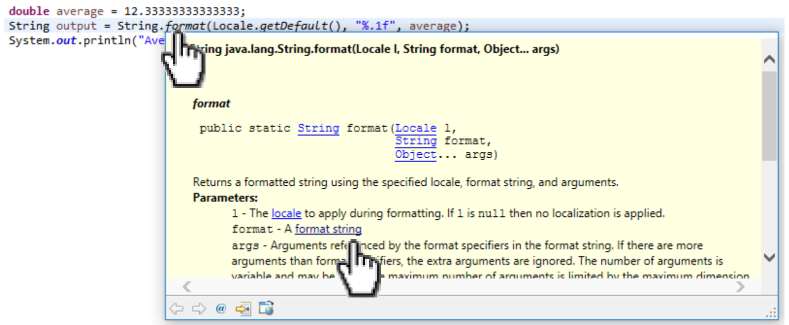
STRING.FORMAT

Format according to default locale settings of computer

```
double average = 12.33333333333333;

String output = String.format(Locale.getDefault(), "%.1f", average);

System.out.println("Average: "+output);
```

Format as a decimal number with one digit after the . (.1f)

Input parameter(s)



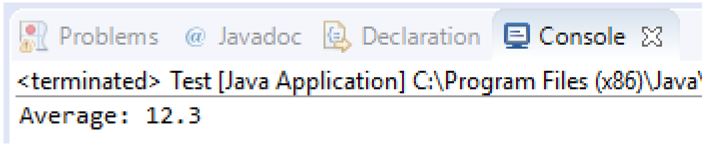
```
double average = 12.33333333333333;
String output = String.format(Locale.getDefault(), "%.1f", average);
System.out.println("Ave
```

ring java.lang.String.format(Locale l, String format, Object... args)

format

```
public static String format(Locale l,
                            String format,
                            Object... args)
```

Returns a formatted string using the specified locale, format string, and arguments.
Parameters:
l - The locale to apply during formatting. If l is null then no localization is applied.
format - A format string
args - Arguments ref[illegible]nced by the format specifiers in the format string. If there are more arguments than form[illegible]ifiers, the extra arguments are ignored. The number of arguments is variable and may be [illegible] maximum number of arguments is limited by the maximum dimension



```
<terminated> Test [Java Application] C:\Program Files (x86)\Java\
Average: 12.3
```

SCOPE OF VARIABLES

{ Scope: region in code where a variable (or object) is valid. }

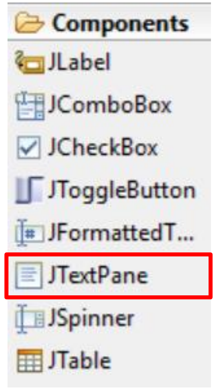
```
public class TemperaturePanel extends JPanel {
  WeatherStation w;

  public TemperaturePanel(int id) {
      JLabel labelTemp = new JLabel("25.7");

      w = new WeatherStation(id);

      String temp = w.readTemperature();

      labelTemp.setText(temp);
  }

  public double getTemperature() {
      String temperature = w.readTemperature();
      ...
  }
}
```

Object **`w`** is a *class-variable* in class **`TemperaturePanel`**

`temp` is a *local variable* valid in the constructor

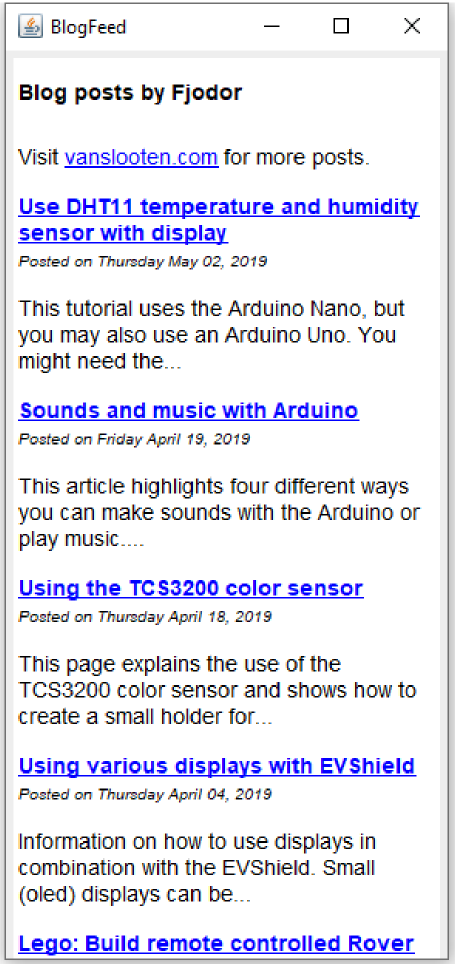
Object **`w`** can be used by all methods

LIBRARIES



- **`java.net, org.w3c, javax.xml`**: Libraries for internet applications & XML
- XML: Extensible Markup Language (Standard Data Exchange)
- Show webpage in textPane:

```
try {
   textPane.setPage("https://home.et.utwente.nl/slootenvanf/feed.php");
} catch (IOException e) {
   e.printStackTrace();
}
```



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CREATE (DESIGN) A METHOD YOURSELF

1. Think of a name (**what** should the method do?)
2. Write Pseudo code
3. Think of things the method should do (**how** does the method …?)
4. Does the method have to return something? (a result)

CREATE (DESIGN) A METHOD YOURSELF

TODAYS ASSIGNMENT

Add a method to TemperaturePanel which gets the temperature as a number

Step 1:

1. Think of a name for the method (**what** should the method do?) → get temperature
2. Write Pseudo code →
3. Think of things the method should do (**how** does the method …?) →

```
get temperature() {
    get temperature from weather station
    convert temperature to number
}
```

4. Does the method have to return something? (a result) → yes, a number

What is the type of the number?

Step 2:

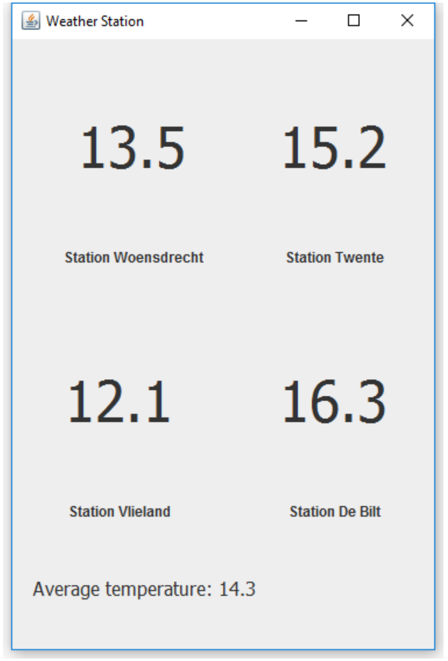
```
public ??? getTemperature() {
    // get temperature from weather station
    // convert temperature to number
    return number;
}
```

Step 3: put method into the class

add code at the 2 lines of comments

ASSIGNMENT #3

Deadline of each assignment is the next session
This one: May 8



13.5 15.2

Station Woensdrecht Station Twente

12.1 16.3

Station Vlieland Station De Bilt

Average temperature: 14.3

- “Create an application that can show weather-data from multiple weather stations”
- Extra challenge & appendix: get temperature from connected Arduino
- Try examples/self-study

Slides, assignments etc @ vanslooten.com/appdev