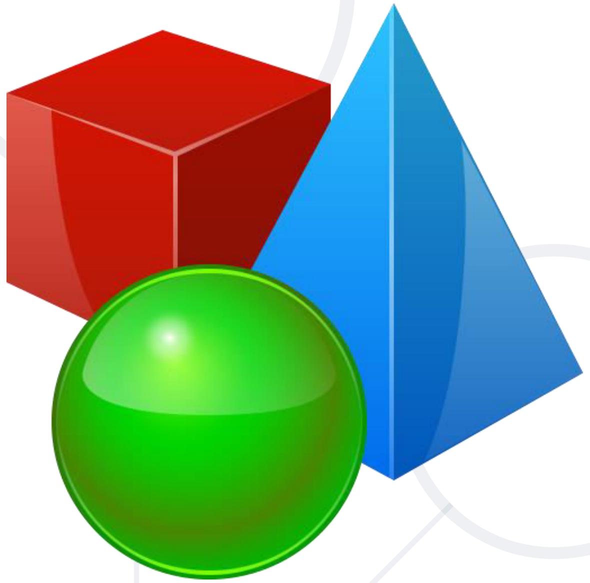
Objects and Classes

Using Objects and Classes
Defining Simple Classes



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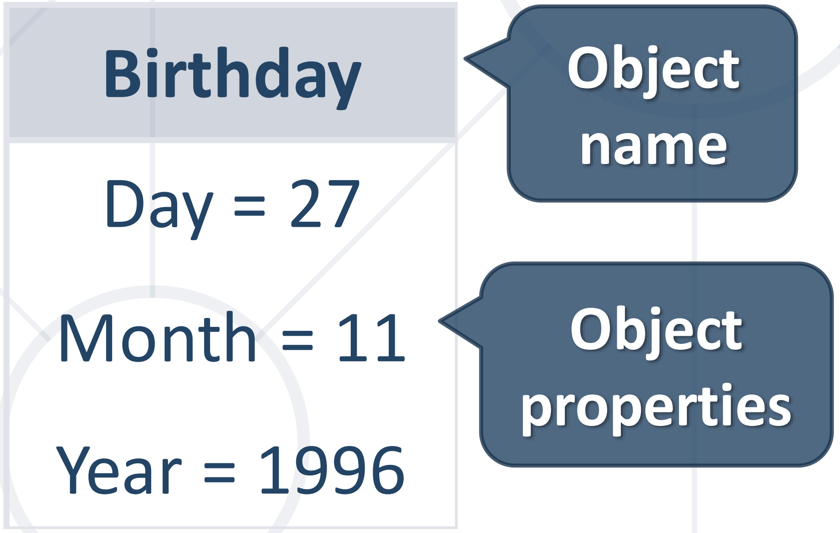
Objects and Classes

What Is an Object? What Is a Class?

Objects

- An **object** holds a set of named values
  - E.g. **birthday** object holds day, month and year
  - Creating a birthday object:

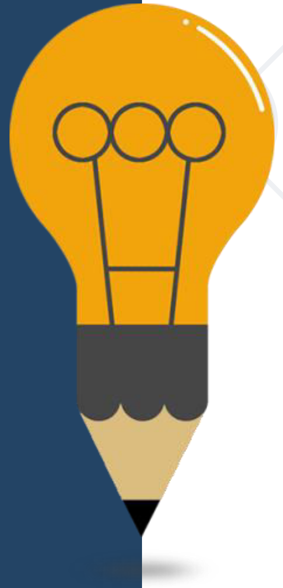


```
LocalDate birthday =
LocalDate.of(2018, 5, 5);
System.out.println(birthday);
```

Create a new object of type LocalDate

Classes

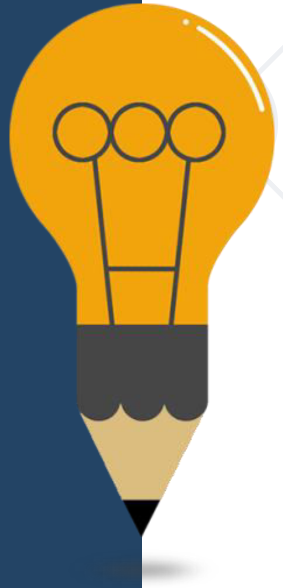
- In programming, **classes** provide the structure for **objects**
  - Act as **template** for **objects** of the same type
- Classes define:
  - Fields (**private variables**), e.g. **day**, **month**, **year**
  - Data, e.g. `getDay`, `setMonth`, `getYear`
  - Actions (**behavior**), e.g. `plusDays(count)`, `subtract(date)`
- One class may have many instances (objects)
  - Sample class: `LocalDate`
  - Sample objects: `PeterBirthday`, `MariaBirthday`



Objects – Instances of Classes

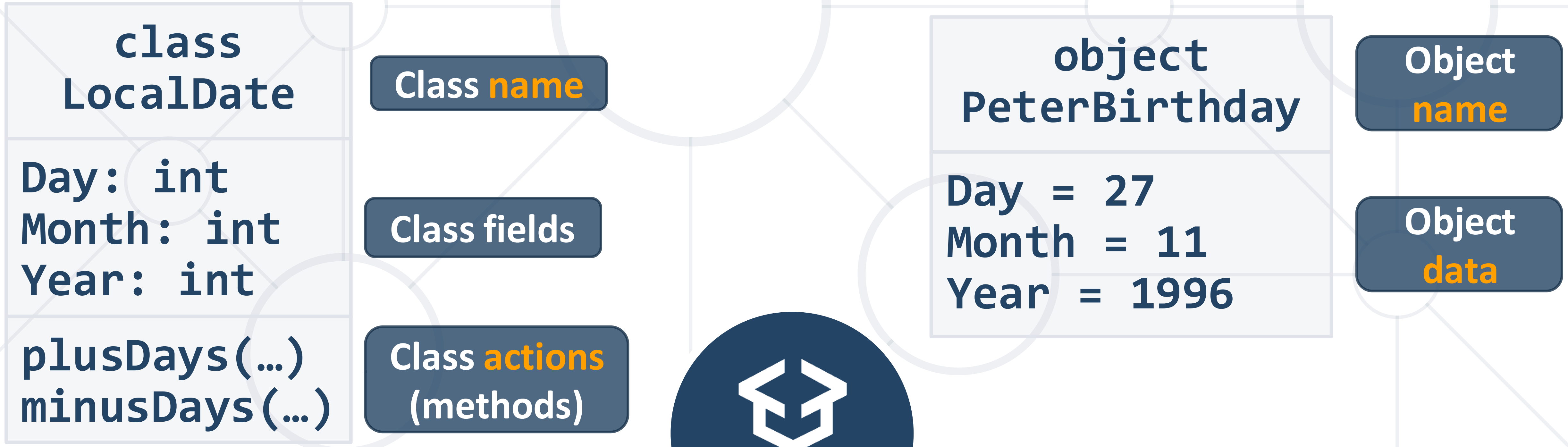
- Creating the object of a defined class is called **instantiation**
- The **instance** is the object itself, which is created runtime
- All instances have common **behaviour**

```
LocalDate date1 = LocalDate.of(2018, 5, 5);
LocalDate date2 = LocalDate.of(2016, 3, 5);
LocalDate date3 = LocalDate.of(2013, 3, 2);
```



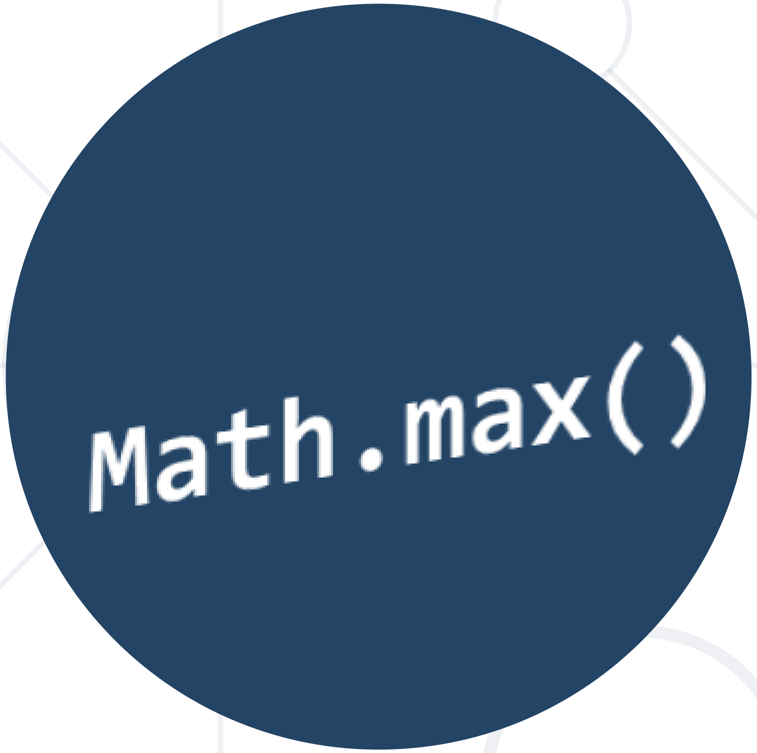
Classes vs. Objects

- Classes provide structure for creating objects
- An object is a single instance of a class



```
class
LocalDate
Day: int
Month: int
Year: int
plusDays(…)
minusDays(…)
```

```
object
PeterBirthday
Day = 27
Month = 11
Year = 1996
```


`Math.max()`

Using the Built-In API Classes

Math, Random, BigInteger, ...

Built-In API Classes in Java

- Java provides ready-to-use classes
  - Organized inside Packages like: `java.util.Scanner`, `java.utils.List`, etc.
- Using static class members:

```java
LocalDateTime today = LocalDateTime.now();
double cosine = Math.cos(Math.PI);
```

- Using non-static Java classes

```java
Random rnd = new Random();
int randomNumber = rnd.nextInt(99);
```

Problem: Randomize Words

- You are given a list of words
  - Randomize their order and print each word at a separate line

```
a b
```

```
b
a
```

```
PHP Java C#
```

```
Java
PHP
C#
```

Note: the output is a sample. It should always be different!

Check your solution here: https://judge.softuni.bg/Contests/1319/

Solution: Randomize Words

```java
Scanner sc = new Scanner(System.in);
String[] words = sc.nextLine().split(" ");
Random rnd = new Random();
for (int pos1 = 0; pos1 < words.length; pos1++) {
   int pos2 = rnd.nextInt(words.length);
   //TODO: Swap words[pos1] with words[pos2]
}
System.out.println(String.join(System.lineSeparator(), words));
```

Check your solution here: https://judge.softuni.bg/Contests/1319/

Problem: Big Factorial

- Calculate n! (n factorial) for very big n (e.g. 1000)

```
5 → 120
10 → 3628800
12 → 479001600
50 → 3041409320171337804361260816606476884437764156
     8960512000000000000
88 → 1854826422573984391147968456455462843802209689
     4939934668442158098688956218402819931910014124
     480450182841663351685120000000000000000000000
```

Check your solution here: https://judge.softuni.bg/Contests/1319/

Solution: Big Factorial

```
import java.math.BigInteger;
...
int n = Integer.parseInt(sc.nextLine());
BigInteger f =
       new BigInteger(String.valueOf(1));
for (int i = 2; i <= n; i++)
  f = f.multiply(BigInteger.valueOf(
      Integer.parseInt(String.valueOf(i))));
System.out.println(f);
```

Use the java.math.BigInteger

N!

Check your solution here: https://judge.softuni.bg/Contests/1319/

Defining Classes

Creating Custom Classes

Defining Simple Classes

- Specification of a given type of objects from the real-world
- Classes provide structure for describing and creating objects

Keyword

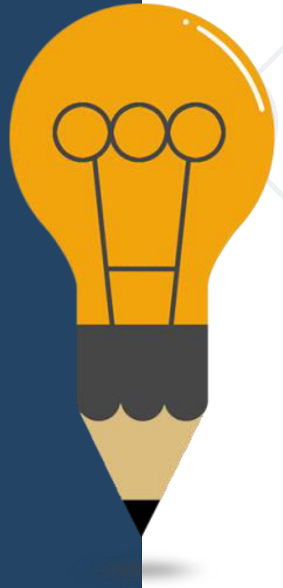
Class name

```
class Dice {
    …
}
```

Class body

Naming Classes

- Use PascalCase naming
- Use descriptive nouns
- Avoid abbreviations (except widely known, e.g. URL, HTTP, etc.)



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```
class Dice { … }
class BankAccount { … }
class IntegerCalculator { … }
```

```
class TPMF { … }
class bankaccount { … }
class intcalc { … }
```

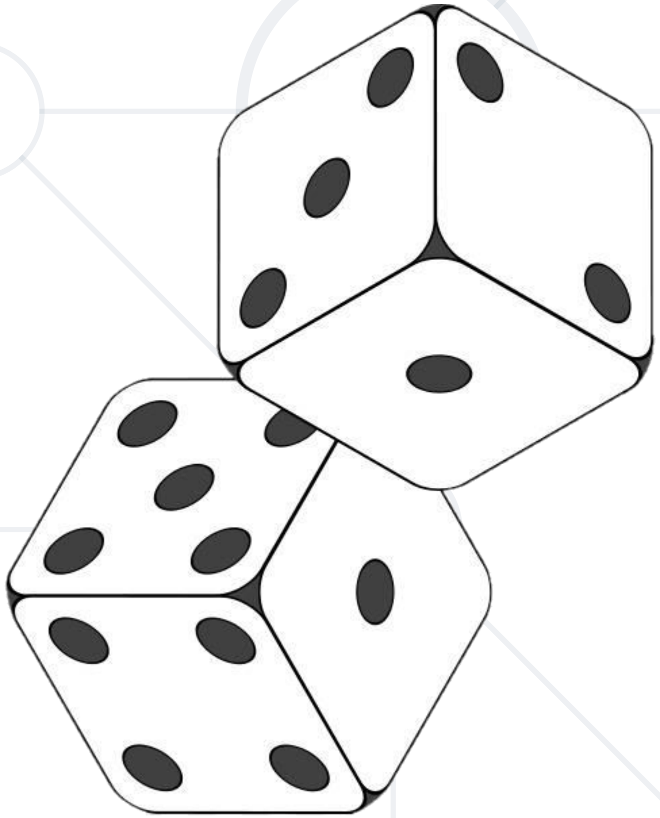
Class Members

- Class is made up of **state** and **behavior**
- Fields **store values**
- Methods **describe behaviour**

```
class Dice {
  private int sides;
  private String type;
  public void roll() { … }
}
```

Fields

Method



Getters and Setters

```
class Dice {
  public int getSides() { return this.sides; }
  public void setSides(int sides) {
    this.sides = sides;
  }
  public String getType() { return this.type; }
  public void setType(String type) {
    this.type = type;
  }
}
```

Properties

Creating an Object

- A class can have many instances (objects)

```
class Program {
  public static void main(String[] args) {
    Dice diceD6 = new Dice();
    Dice diceD8 = new Dice();
  }
}
```

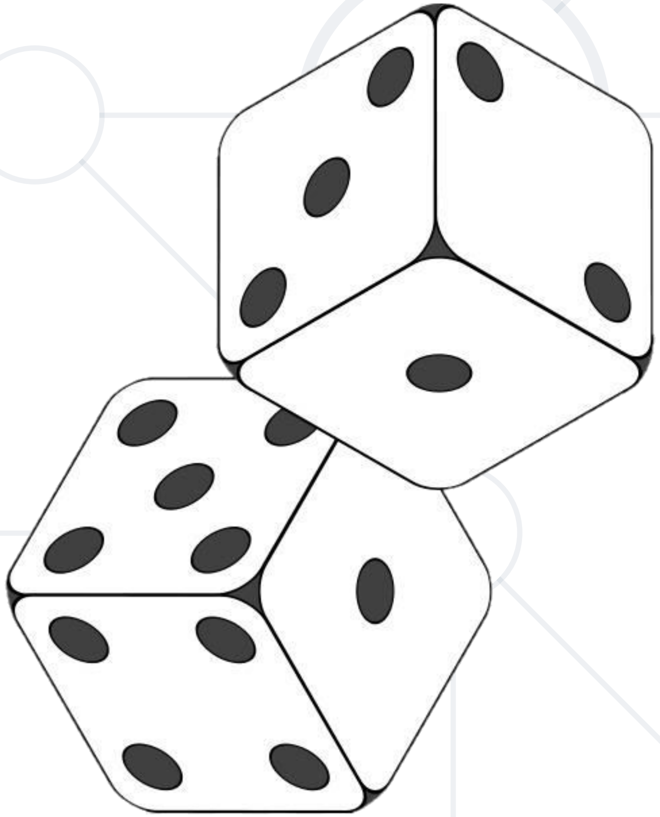
Use the **new** keyword

Variable stores a **reference**

Methods

- Store executable code (algorithm)

```
class Dice {
  public int sides;
  public int roll() {
    Random rnd = new Random();
    int sides = rnd.nextInt(this.sides + 1);
    return sides;
  }
}
```



Constructors

- Special methods, executed during object creation

```
class Dice {
  public int sides;
  public Dice() {
    this.sides = 6;
  }
}
```

Overloading default constructor

Constructor name is the same as the name of the class

Constructors (2)

- You can have multiple constructors in the same class

```
class Dice {
  public int sides;
  public Dice() { }
  public Dice(int sides) {
    this.sides = sides;
  }
}
```

```
class StartUp {
public static void main(String[] args) {
  Dice dice1 = new Dice();
  Dice dice2 = new Dice(7);
  }
}
```

Live Exercises

Summary

- Classes define templates for object
  - **Fields**
  - **Constructors**
  - **Properties**
  - **Methods**
- Objects
  - holds a set of **named values**
  - **Instance** of a class

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