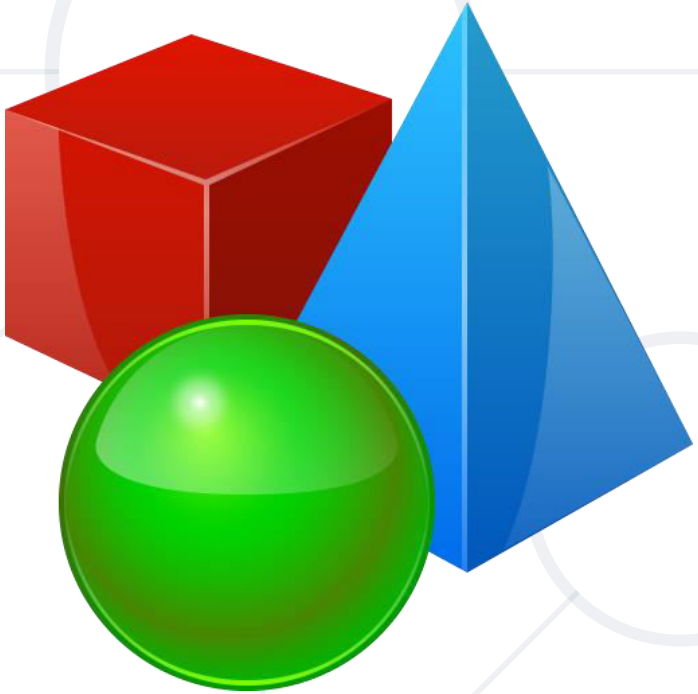
Defining Classes

Classes, Fields, Constructors, Methods



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Defining Classes

Defining Simple Classes

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

Keyword

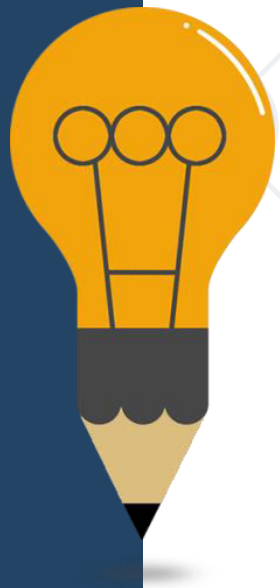
Class name

```
class Car {
    …
}
```

Class body

Naming Classes

- Use PascalCase naming
- Use descriptive nouns
- Avoid ambiguous names



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

```
class TPMF { … }
class bankaccount { … }
class numcalc { … }
```

Class Members

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

```
class Car {
  String make;
  String model;
  void start(){ … }
}
```

Fields

Method

```
class Dog {
  int age;
  String type;
  void bark(){ … }
}
```

Fields

Method

Creating an Object

- A class can have **many instances** (objects)

```
class Program {
  public static void main()
  {
    Car firstCar = new Car();
    Car secondCar = new Car();
  }
}
```

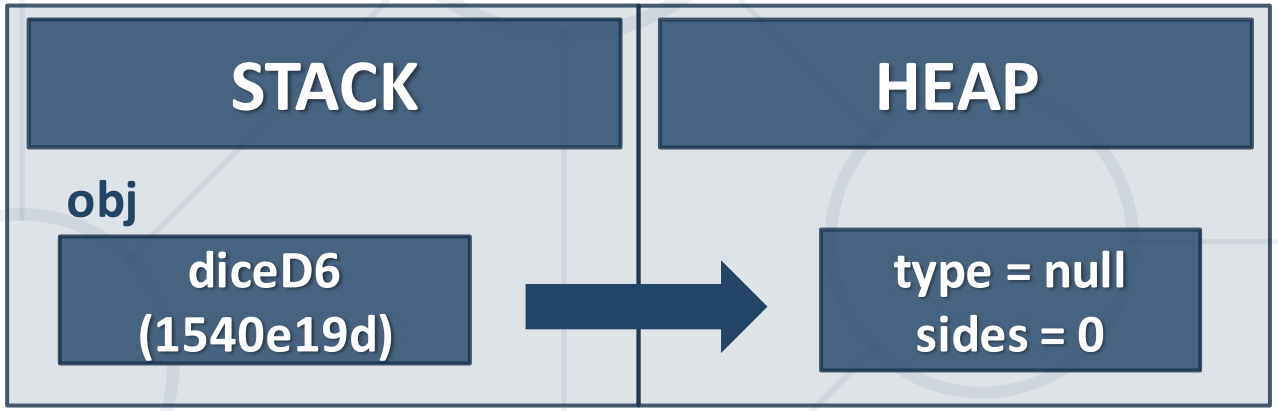
Variable stores a reference

Use the new keyword

Object Reference

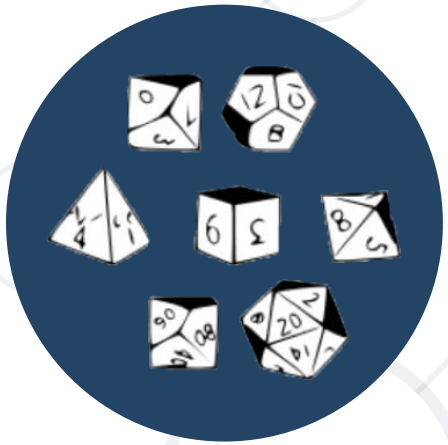
- Declaring a variable creates a **reference** in the stack
- The **new** keyword allocates memory on the heap

```
Car car = new Car();
```

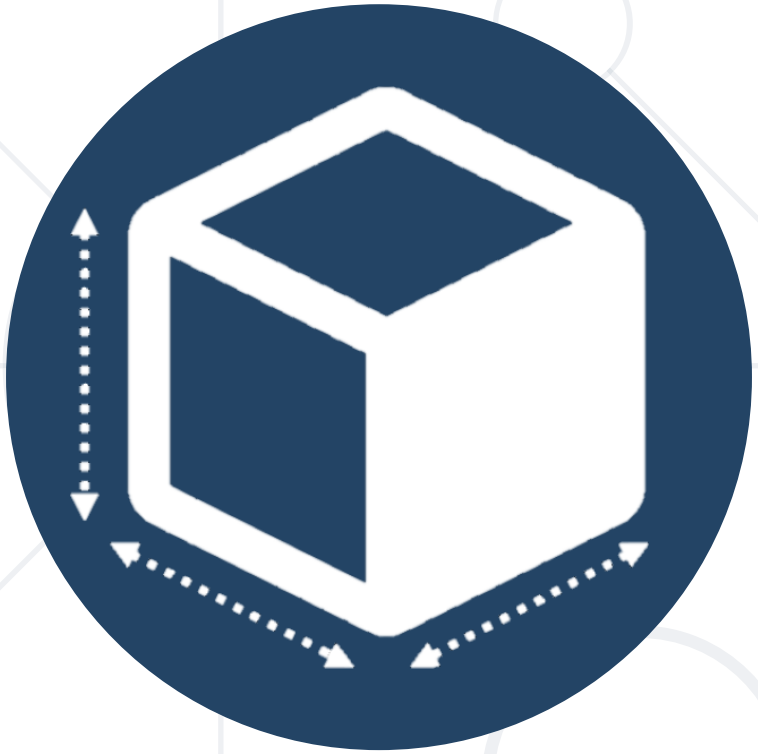


Classes vs. Objects

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



Dice (Class) → D6 Dice (Object)



Class Data

Storing Data Inside a Class

Fields

- Class fields have **access modifiers**, **type** and **name**

```
public class Car {
  private String make;
  private int year;
  public Person owner;
  …
}
```

access modifier

type

name

Fields can be of **any type**

Problem: Define Car Class

- Create a class **Car**

```
Car
```

Class name

```
+make:String
+model:String
+horsePower:int
```

Class fields

```
(no actions)
```

Class methods

```java
public class ClassesLab {
    public static void main(String[] args) {

        Car car = new Car();

        car.make = "Chevrolet";
        car.model = "Impala";
        car.horsePower = 390;

        System.out.println(String.format(
                "The car is: %s, %s - %d HP",
                car.make, car.model, car.horsePower
        ));
    }
}
```

- Ensure proper naming!

Solution: Define Car Class

```
public class Car {
  String make;
  String model;
  int horsePower;
}
```

Access Modifiers

- Classes and class members **have modifiers**
- Modifiers **define visibility**

Class modifier

```
public class Car {
  private String make;
  private String model;
}
```

Member modifier

Fields should always be private!

Methods

Defining a Class Behaviour

Methods

- Store **executable code** (algorithm) that manipulate state

```
class Car {
  private int horsePower;

  public void increaseHP(int value) {
    horsePower += value;
  }
}
```

Getters and Setters

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- Used to create **accessors** and **mutators** (**getters** and **setters**)

```
class Car {
  private int horsePower;
  public int getHorsePower() {
    return this.horsePower;
  }

  public void setHorsePower(int horsePower) {
    this.horsePower = horsePower;
  }
}
```

Field is hidden

Getter provides access to field

this points to the current instance

Setter provide field change

Getters and Setters

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- Keyword **this**
  - Prevent field hiding
  - Refers to a current object

```
private int horsePower;
public void setSides(int horsePower) {
  this.horsePower = horsePower;
}

public void setSidesNotWorking(int horsePower) {
  horsePower = horsePower;
}
```

Problem: Car Info

- Create a class **Car**

- == private

Car
-make:String …
+setMake():void +getMake():String … +carInfo():String

return type

+ == public

```java
public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        Car car = new Car();

        car.setMake("Chevrolet");
        car.setModel("Impala");
        car.setHorsePower(390);

        System.out.println(car.carInfo());
    }
}
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Solution: Car Info

```
public class Car {
  private String make;
  private String model;
  private int horsePower;
  public void setMake(String make) { this.make = make; }
  public String getMake() { return this.make; }
  public String carInfo() {
    return String.format("The car is: %s %s - %d HP.",
    this.make, this.model, this.horsePower);
  }
  //TODO: Create the other Getters and Setters
}
//TODO: Test the program
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Constructors

Object Initialization

Constructors

- Special methods, executed during object creation
- The only one way to **call a constructor** in Java is through the **keyword new**

```
public class Car {
  private String make;
  public Car() {
    this.make = "BMW";
  }
}
```

Overloading default constructor

Constructors (1)

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- Special methods, executed during object creation

```
class Car {
  private String make;
  …
  public Car() {
    this.make = "unknown";
    …
  }
}
```

Overloading default constructor

Constructors (2)

- You can have multiple constructors in the same class

```
public class Car {
  private int horsePower; private String make;

  public Car(String make) {
    this.make = make;
  }

  public Car(String make, int horsePower) {
    this.make = make;
    this.horsePower = horsePower;
  }
}
```

Constructor with one parameter

Constructor with all parameters

Object Initial State

- Constructors **set object's initial state**

```
public class Car {
  String make;
  List<Part> parts;

  public Car(String make) {
    this.make = make;
    this.parts = new ArrayList<>();
  }
}
```

Always ensure correct state

Constructor Chaining

- Constructors can **call each other**

```
class Car {
  private String make;
  private int horsePower;

  public Car(String make, int horsePower) {
    this(make);
    this.horsePower = horsePower;
  }

  public Car(String make) {
    this.make = make;
  }
}
```

Problem: Constructors

- Create a class **Car**

Car
-make:String -model:String -horsePower:int
+Car(String make) +Car(String make, String model, int horsePower) +carInfo():String

```java
Car firstCar =
        new Car( make: "Chevrolet");

Car secondCar =
        new Car( make: "Chevrolet",  model: "Impala",  horsePower: 390);

System.out.println(firstCar.carInfo());
System.out.println(secondCar.carInfo());
```

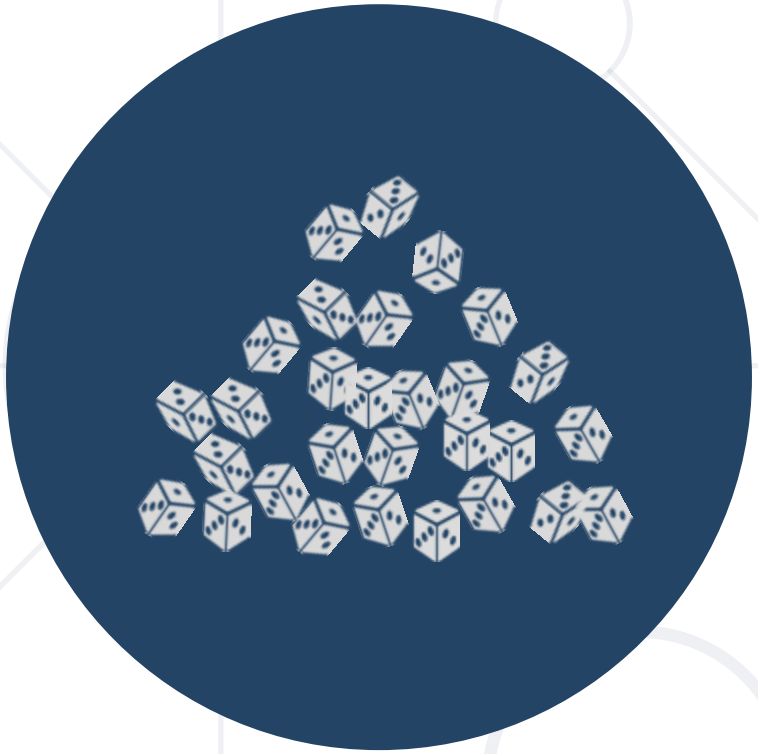
Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Solution: Constructors

```
public Car(String make) {
  this.make = make;
  this.model = "unknown";
  this.horsePower = -1;
}

public Car(String make, String model, int horsePower) {
  this(make);
  this.model = model;
  this.horsePower = horsePower;
}
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab



Static Members

Members Common for the Class

Static Members

- Access static members **through the class name**
- Static members are **shared class-wide**
- You don't **need** an instance

```
class Program {
  public static void main(String[] args) {
    BankAccount.setInterestRate(2.2);
  }
}
```

Sets the rate for all bank accounts

Static Members

```
class BankAccount {
  private static int accountsCount;
  private static double interestRate;

  public BankAccount() {
    accountsCount++;
  }

  public static void setInterestRate(double rate) {
    interestRate = rate;
  }
}
```

Problem: Bank Account

- Create a class **BankAccount**
- Support **commands**:
  - **Create**
  - **Deposit** {ID} {Amount}
  - **SetInterest** {Interest}
  - **GetInterest** {ID} {Years}
  - **End**

BankAccount

```
-id:int (starts from 1)
-balance:double
-interestRate:double (default: 0.02)

+setInterest(double interest):void
+getId():int
+getInterest(int years):double
+deposit(double amount):void
```

underline == static

```
Create
Deposit 1 20
GetInterest 1 10
End
```

```
Account ID1 Created
Deposited 20 to ID1
4.00
```

(20 * 0.02) * 10

Solution: Bank Account

```
public class BankAccount {
  private final static double DEFAULT_INTEREST = 0.02;

  private static double rate = DEFAULT_INTEREST;
  private static int bankAccountsCount;

  private int id;
  private double balance;

  // continue…
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Solution: Bank Account (2)

```
  public BankAccount() {
    this.id = ++bankAccountsCount;
  }

  public static void setInterest(double interest) {
    rate = interest;
  }

  // TODO: int getId()
  // TODO: double getInterest(int years)
  // TODO: void deposit(double amount)
  // TODO: override toString()
}
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Solution: Bank Account (2)

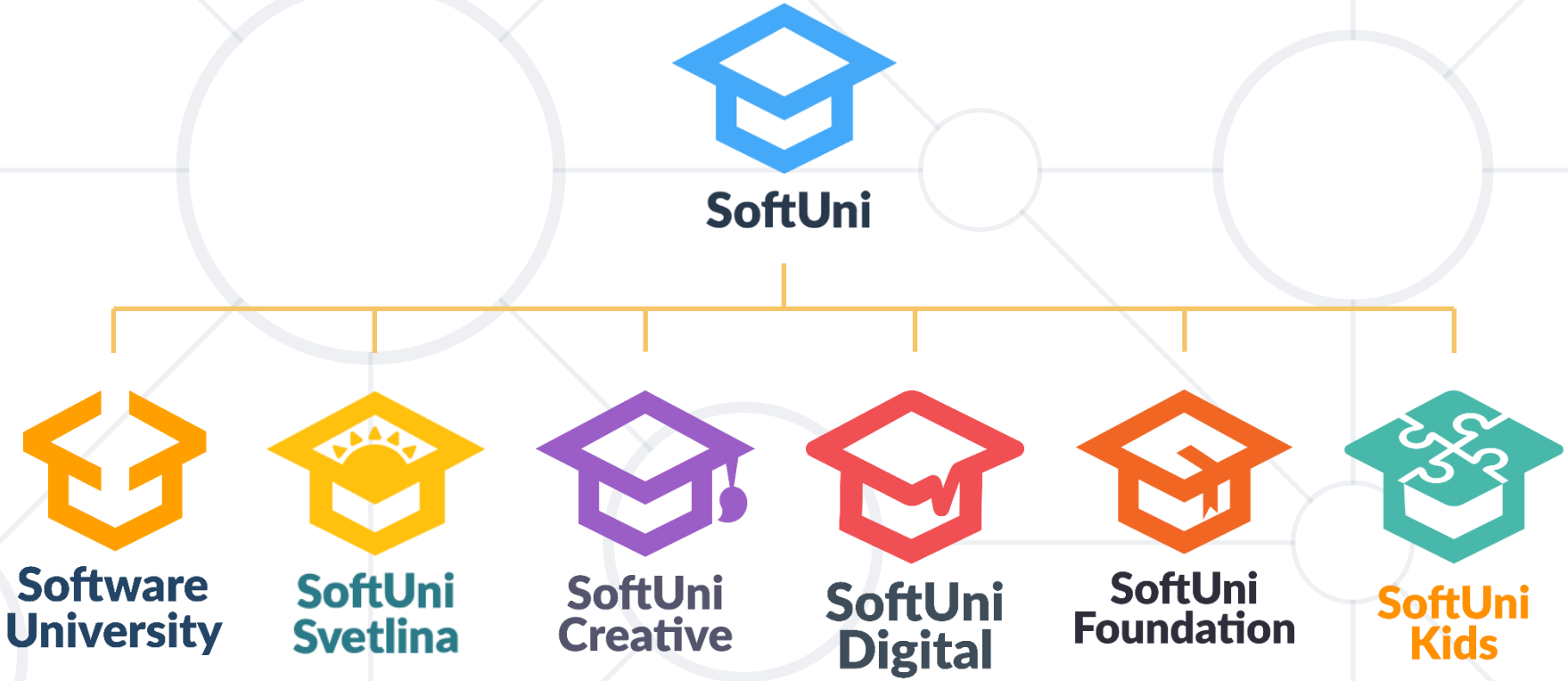
```
HashMap<Integer, BankAccount> bankAccounts = new HashMap<>();
while (!command.equals("End")) {
  //TODO: Get command args
  switch (cmdType) {
    case "Create":      // TODO
    case "Deposit":     // TODO
    case "SetInterest": // TODO
    case "GetInterest": // TODO
  }
  //TODO: Read command
}
```

Check your solution here: https://judge.softuni.bg/Contests/1517/Defining-Classes-Lab

Summary

- Classes define specific **structure** for objects
  - Objects are particular **instances of a class**
- Classes define **fields, methods, constructors** and other members
- Constructors are **invoked** when creating new class instances
- Constructors **initialize** the **object's initial state**

Questions?



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