- signatures
- ByteArray
- Stream.sort() which direction it gets sorted
- stream functions, :
- `Function<T,V> Predicate<T> Stream<T> Collection<T>`
- HashCode-methods
- cannot override final methods
- cannot be subclass of final class

Final (Attributes/Parameters)

TODO

Static (Attributes/Methods)

TODO

Private (Attributes/Methods)

TODO

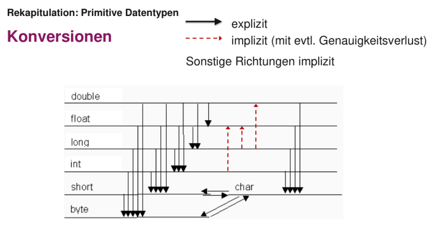
Types

```
long l = 1L; long ll = 0b1l;
float f = 0.0f; long d = 0.0d;
String multiline = """
  Hello, "world"
""";
var ints = new ArrayList<Integer>();
boolean isTrue = 0.1 + 0.1 != 0.2;
```

Variable args

```
long l = 1L; long ll = 0b1l;
static int sum(int... numbers) {
  int sum  = 0;
  for (int i = 0; i < numbers.length; i++) sum +=
numbers[i];
  return sum;
}
```

Implicit casting


Rekapitulation: Primitive Datentypen
Konversionen
explizit
implizit (mit evtl. Genauigkeitsverlust)
Sonstige Richtungen implizit
double
float
long
int
short
char
byte

No information loss `int→float`, to larger type `int→long`
Sub->Super is implicit, Super->Sub ClassCastException

Static vs Dynamic types

TODO

Dynamic dispatch

TODO

Equality

```
s.equals(sOther);            // Strings / Objects
Arrays.equals(a1, a2);       // arrays
Arrays.deepEquals(a1, a2);   // nested arrays

class Student extends Person {
  @Override
  public boolean equals(Object obj) {
    if (obj == null) return false;
    if (getClass() != obj.getClass()) return false;
    if (!super.equals(obj)) return false;
    Student other = (Student) obj;
    return getNumber() == other.getNumber();
  }
}
```

String pooling

```
String first = "hello", second = "hello";
System.out.println(first == second); // true
String third = new String("hello");
String fourth = new String("hello");
System.out.println(third == fourth); // false
System.out.println(third.equals(fourth)); // true
String a = "A", b = "B", ab = "AB";
System.out.println(a + b == ab); // false
```

```
final String d = "D", e = "E", de = "DE";
System.out.println(d + e == de); // true
```

Hashing **TODO**

Switch

```
switch (x) {
  case 'a':
    System.out.println("1");
    break;
  default:
    System.out.println("2");
}
int y = switch (x) {
  case 'a' -> 1;
  default -> 2;
}
```

Visibility

public	*all classes*
protected	package + sub-classes
private	only self
(none)	all classes in same package

Packages

p1.sub won't be automatically imported in p1.
Package name collisions: first gets imported.

```
package p1;
public class A { }

  package p1.sub;
  public class E { }
```

```
package p2;
import p1.sub.E;
public class C {
  E e = new E(); //
*E*
}
```

```
package p1; public class A { }
package p2; public class A { }
import p1.A; import p2.*; // OK
import p1.*; import p2.*; // reference to A is
ambiguous
import static java.lang.Math.*; // sin, PI
```

TODO

Anonymous Classes **TODO**

Initialisation

1) Default-Values ↓
2) Attribute Assignments
3) Initialisation block
4) Constructor

Default Values

Type	*Default*	*Type*	*Default*
boolean	false	char	'\u0000'
byte	0	short	0
int	0	long	0L
float	0.0f	double	0.0d

IO

TODO

Enums

TODO

```
public enum Weekday {
  MONDAY(true), TUESDAY(true), WEDNESDAY(true),
  THURSDAY(true), FRIDAY(true),
  SATURDAY(false), SUNDAY(false);

  private boolean workDay;

  Weekday(boolean workDay) { // private constructor
    this.workDay = workDay;
  }
  public boolean isWorkDay() {
    return workDay;
  }
}
```

Overloading

Gets statically chosen by compiler? But Errors happen at runtime? wtf java?

```
void print(int i, double j) { }    // 1
void print(double i, int j) { }    // 2
void print(double i, double j) { } // 3

print(1.0, 2.0);  // 3
print(1, 2); // error: reference to print is
ambiguous
print(1.0, 2);    // 2
```

TODO

Overriding

Dynamically chosen (Dynamic dispatch / Virtual call)

TODO: Dynamischer Typ des Objektes entscheided, welche Methode aufgerufen wird

Error: Cannot override the final method…
Error: Cannot be subclass of final class…

Hiding

```
super.description == ((Vehicle)this).description
super.super // doesn't exist, use v
((SuperSuperClass)this).variable
```

Abstract classes

```
public abstract class Vehicle {
  private int speed;
  public abstract void drive();
  public void accelerate(int acc) {
    this.speed += acc;
  }
}
public class Car extends Vehicle {
  public void drive() { }
  @Override
  public void accelerate (int acc) { }
}
```

Interfaces default methods

```
interface Vehicle {
  default void printModel() {
     System.out.println("Undefined vehicle model");
  }
}
```

Interfaces

Cannot have Attributes

```
interface RoadV {
  int MAX_SPEED = 120;
  void drive();
}
interface WaterV {
  int MAX_SPEED = 80;
  void drive();
}
class AmphibianMobile implements RoadV, WaterV {
  @Override // because ambiguous
  public void drive() {
    println(RoadV.MAX_SPEED); // MAX_SPEED ambiguous
  }
}

interface RoadV { String getModel(); }
interface WaterV { int getModel(); }
// Error, because of different return types
class AmphibianMobile implements RoadV, WaterV { }
```

TODO: mby more interfaces stuff *Inheritance*

```
public class Vehicle {
   private int speed;
   public Vehicle(int speed) {
    this.speed = speed;
   }
}
public class Car extends Vehicle {
   private int doors;
   public Car(int speed, int doors) {
     super(speed);
     this.doors = doors;
   }
}
Car c     = new Car(); // Points to Car
Vehicle v = new Car(); // Points to Car
Object o  = new Car(); // Points to Car
// ^statisch    ^dynamisch
Car c = (Car) new Vehicle(); // ClassCastException
```

```
public class Qwer {
  public void print() {
    System.out.println("1");
  }
}
public class Asdf extends Qwer {
  @Override
  public void print() {
    System.out.println("2");
  }
  public void dostuff () { }
}
var x = new Asdf();
x.print();              // 2
((Qwer) x).print();    // 2
((Qwer) x).dostuff(); // cannot find symbol
```

Statischer Typ: Gemäss Variablendeklaration zur Compile-Zeit
Dynamische Typ: Effektiver Typ der Instanz zur Laufzeit

Serializable

Compiler Quirks

Iterators

```
Iterator<String> it = stringList.iterator();
while (it.hasNext()) {
  String s = it.next();
  System.out.println(s);
}
```

Mutating Collection whilst iterating over it: ConcurrentModificationException
Set: No duplicates

Exceptions

ArithmeticException, NullPointerException, ArrayIndexOutOfBoundsException

```
void test() throws ExceptionA, ExceptionB {
  String c = clip("asdf");
  throw new ExceptionB("wack");
}
try { test() } catch (ExceptionA | ExceptionB e) { }
finally { }
```

Try with

```
try (var output = new FileOutputStream("f.txt")) {
  output.write("Hello".getBytes());
} catch (IOException e) {
  System.out.println("Error writing file.");
}
```

Serializing

```
class X implements Serializable { }
// Serializing
try (var stream = new ObjectOutputStream(
    new FileOutputStream("s.bin"))) {
  stream.writeObject(new X());
}
// Deserializing
try (var stream = new ObjectInputStream(
    new FileInputStream("s.bin"))) {
  X x = (X) stream.readObject();
}
```

Comparable

```
var l = new ArrayList<Integer>(asList(3,2,4,5,1));
l.sort((a, b) -> a > b ? 1 : -1); // ==
l.sort((a, b) -> a - b);          // 1,2,3,4,5

class Person implements Comparable<Person> {
  private final String firstName, lastName;
  @Override
  public int compareTo(Person other) {
    int result = lastName.compareTo(other.lastName);
    if (result == 0)
      result = firstName.compareTo(other.firstName);
    return result;
  }

  static int compareByAge(Person p1, Person p2) {
    return Integer.compare(p1.getAge(),
p2.getAge());
  }
}
List<Person> people = ...;
Collections.sort(people);
people.sort(Person::compareByAge);

class AgeComparator implements Comparator<Person> {
   @Override
   public int compare(Person p1, Person p2) {
     return Integer.compare(p1.getAge(),
p2.getAge());
   }
}
Collections.sort(people, new AgeComparator());
people.sort(new AgeComparator());

people.sort(Comparator
  .comparing(Person::getAge)
  .thenComparing(Person::getFirstName)
  .reversed())
```

Predicate

```
static void removeAll(Collection<Person> collection,
    Predicate criterion) {
  var it = collection.iterator();
  while (it.hasNext())
    if (criterion.test(it.next()))
      it.remove();
}
```

Lambdas

```
String pattern = readFromConsole();
//     vvv not final -> Error
while (pattern.length() == 0)
  pattern = readFromConsole();
Utils.removeAll(people, p ->
    p.getLastName().contains(pattern));
// local variable ... referenced from a lambda
expression must be final or effectively final
```

Streams

```
import java.util.stream.*;

people
  .stream()
  .distinct()
  .filter(p -> p.getAge() >= 18)
  .skip(5)
  .limit(10)
  .map(p -> p.getLastName())
  .sorted()
  .forEach(System.out::println);
```

Terminal operations:
forEach(Consumer), forEachOrdered(Consumer), count(), min(), max(), average(), sum(), findAny(), findFirst()