ESOP – Simple Programs

Assoc. Prof. Dr. Mathias Lux
ITEC / AAU

Agenda

- Symbols
- Variables, Constants
- Assignments
- Operators

Quelle für die folgenden Folien: ***Grundlagen der Programmierung,*** *Prof. Dr. Hanspeter Mössenböck*

Symbols: names

Naming of variables, types, functions, etc. within a program.

- consist of letters, digits and ‚_‘
- always start with a letter
- arbitrary length
- case sensitive

- Examples
  - x, x17, my_Var, myVar

Symbols: key words

- Name key parts of the program
- cannot be used as names

- Examples:
  - if, while, for, enum, class, static, ...

Symbols: numbers

- Discrete numbers
  - (decimal or hexadecimal)
- Floating point numbers

- Examples
  - 376 … decimal
  - 0x1A5 … hexadecimal
  - 3.14 … floating point

Symbols: strings

- Any strings between quotation marks.
- Must not exceed end of lines
- " needs to be excaped to \"

- Examples
  - "a simple string"
  - "she said \"Hallo\""

Symbols: strings

- String
  - in Java not a base data type but an onject.
- char … single Unicode letter
  - 2 Bytes
  - simple apostrophe, eg. ‘L’, ‘)’, …

Declaration of variables

- Each variable must be declared before use
  - Name and type are given to the compiler
  - Compiler allocates memory
- Examples:
  - `int x;` … declares variable x of type int (integer)
  - `short a, b;` … declares two variables of type short (short integer)

Integer types

byte	8 bit	-2^7 .. 2^7-1	(-128 .. 127)
short	16 bit	-2^15 .. 2^15-1	(-32.768 .. 32.767)
int	32 bit	-2^31 .. 2^31-1	(-2.147.483.648 ..)
long	64 bit	…	…

- Declaration & initialisation
  - `int x = 100;`
    declares integer x and assign value of 100.
  - `short a = 0, b = 1;`
    declares two short variables with initial values.

Constants

- Init variables that cannot be changed later
  - static final int max = 100;
- Why would you do that?
  - readability
    - max easier to read than 100
  - maintainability
    - if the same value is used several times.
- Constants are declared in class scope
  - will be explained later in the course

Comments

- line comments
  - Start with // .. and with end-of-line (EOL)
- block comments
  - use /* ... */, can span over multiple lines.

- Comments & Readability
  - comment for later understanding
  - do not comment what‘s obvious

```
// Hier ist ein Zeilenkommentar

int x = 15; // Initialisierung an dieser Stelle erforderlich!
short y = -12;

/* ************************************************
   Dieses Programm wurde von Mathias Lux geschrieben
   ************************************************ */
```

Language for comments and names

- Think about your audience
  - English is better than German
- Do not mix languages!

- Special care with
  - swear words, email adresses, people names, licenses!

Explore Gist Blog Help dermotte

Search shit Search

- Repositories 203
- Code 26,340
- Issues 2,815
- Users 31

Languages

C	224,353
HTML	34,242
JavaScript	
GAS	25,739
Less	23,338
C++	18,093
PHP	15,306
XML	9,977
Ruby	9,436
Markdown	8,795

Advanced search Cheat sheet

We've found 26,340 code results

Sort: Best match

romankalb/PMapp – main.js JavaScript
Last indexed on 3 Aug

```
1  debug("Shit");
```

matthewcv/nodestuff – mmcolors.js JavaScript
Last indexed on 31 Jul

```
1  alert('shit');
```

lwl8851206/HelloWorld – test.js JavaScript
Last indexed on 29 Jul

```
1  function shit(){}
```

ACSvsFMI/theDoctors – shit.js JavaScript
Last indexed on 25 Jul

```
1  alert('shit')
```

nitirajrathore/testrepo – tits.js JavaScript
Last indexed on 2 Aug

```
1  alert("fucking dick shit")
```

gpestana/legacy_slick.js – core_tests.js JavaScript
Last indexed on 1 Aug

```
1  /*Tests and shit.. */
```

bmelon11/myrepo – boo.js JavaScript
Last indexed on 28 Jul

```
1  console.log("eat shit")
```

apiengine/apiengine-client – page.js JavaScript
Last indexed on 23 Jul

```
1  some profile shit goes here
```

AchintyaAshok/NYT---Intern-Project-Front-End – storyView.js JavaScript
Last indexed on 28 Jul

```
1  console.log('django is shit');
```

JamieAppleseed/jamieappleseed.com – application.js JavaScript
Last indexed on 8 Aug

```
1  (function(win){
2    // do shit
3  })(this);
```

Choice of variables and constants

- Coding conventions exist for
  - readability of code
  - maintainability and preservation
- Naming conventions see:
  http://www.oracle.com/technetwork/java/javase/documentation/codeconventions-135099.html#367
- Tipps:
  - Names that make sense (cp. comments)
  - Better shorter than longer (cp. support by IDE).

No good naming ..

aeonsf/footlocker – dpc-hashcrack.py
Last indexed on 31 Jul

Python

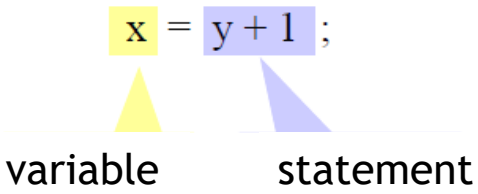
```
51                  return licker
52
53  def toptobottom(crack):
54          i = 0
55          while i < (len( asshole )/2):
56                  if len(crack) == 32:
57                          if crack == md5(asshole[i]):
…
57                          if crack == md5( asshole [i]):
58                                  print "\n\t[p1] 3===D  passwd is = %s\n"% asshole [i]
59                                  break
60                  elif len(crack) == 40:
```

hallfox/teampython – ex10b.py
Last indexed on 3 Aug

Python

```
5   escape4 = "%s is a total  asshole ."
6
7   asshole  = "Tyler \t\nFUCK\n Sontag \\"
8
9   singlequotepreformatting = '''
10  This looks a lot cleaner and minimalistic.
…
12  For now on, let's use the single quotes instead.
13  '''
14
15  print escape1
16  print escape2
17  print escape3
18  print escape4 %  asshole
19  print singlequotepreformatting
```

Assignments



1. compute statement
2. store in variable

- left and right side have to be compatible
  - either the same type (int, byte, ...)
  - or type left ⊇ type right
- hierarchy of integer types
  - long ⊇ int ⊇ short ⊇ byte

Assignments

- Examples

```
int i, j; short s; byte b;
i = j;          // ok: same type
i = 300;        // ok (numeric expressions are int)
b = 300;        // not ok: 300 > byte
i = s;          // ok
s = i;          // not ok
```

Static Type Check

- Compiler checks:
  - variables stay in allowed value range.
  - operators are applied on the right types / values.

Arithmetic Expressions

- Simplified grammar

```
Expr = Operand {BinaryOperator Operand}.
Operand = [UnaryOperator] ( identifier | number | "(" Expr ")" ).
```

- eg. `- x + 3 * (y + 1)`

Arithmetic Expressions

- Binary Operators

+	sum	
-	subtraction	
*	multiplikation	
/	division	`5/3 = 1`
%	modulo	`5%3 = 2`

- Unary operators

+	identity	`(+x) = x`
-	invert sign	

Types in Arithmetic Expressions

- Order of operations
  - multiplication and division (*, /, %) over addition and subtraction (+, -)
    - eg. 2 + 3 * 4 = 14
  - left association
    - eg. 7 - 3 - 2 = 2
  - unary operators over binaray operators
    - eg.: -2 * 4 + 3 ergibt -5
- Resulting types
  - input type can be byte, short, int, long
  - resulting type
    - if one operand is long -> result is type long,
    - otherwise -> type int

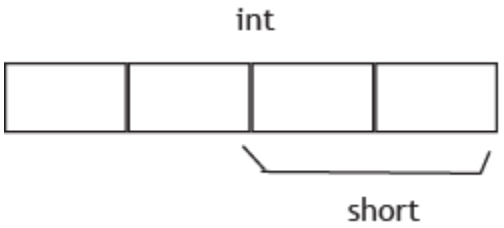
Examples

```
short s; int i; long x;
x = x + i;              // long
i = s + 1;              // int (1 is int)
s = s + 1;              // false!
s = (short)(s + 1);     // type cast necessary
```

Type Cast

`(type) expression`

- changes *expression* to *type*
- result can be truncated



Increment / Decrement

- access variable plus operation
  - x++ ... returns x and then adds +1
  - ++x ... adds 1 to x and then returns x
  - x-- , --x ... the same with subtraction.
- can be a statement on ist own right
  - x = 1; x++; // x = 2 the same as: x = x + 1;
- examples
  - x = 1; y = x++ * 3; // x = 2, y = 3 is: y = x * 3; x = x + 1;
  - x = 1; y = ++x * 3; // x = 2, y = 6 is: x = x + 1; y = x * 3;
- only works on variables, not expressions.
  - y = (x + 1)++; // wrong!

The power of two (shifts)

Shift-operators allow for efficient multiplication and division by powers of two.

Multiplikation	
x * 2	x << 1
x * 4	x << 2
x * 8	x << 3
x * 16	x << 4
...	...

Division	
x / 2	x >> 1
x / 4	x >> 2
x / 8	x >> 3
x / 16	x >> 4
...	...

Division only works out for positive numbers.

The power of two (shifts)

Examples

x = 3;

0000 0011

x = x << 2; // 12

0000 1100

x = -3;

1111 1101

x = x << 1; // -6

1111 1010

x = 15;

0000 1111

x = x >> 2; // 3

0000 0011

Assignment operators.

- arithmetic operations can be combined with assignments.

	short	long
+=	x += y;	x = x + y;
-=	x -= y;	x = x - y;
*=	x *= y;	x = x * y;
/=	x /= y;	x = x / y;
%=	x %= y;	x = x % y;

check http://docs.oracle.com/javase/specs/jls/se8/html/jls-15.html#jls-15.26

String Operators

- Strings can be concatenated with ‘+’
  - “Mathias” + “ “ + “Lux”
- Other operators do not apply
  - Especially not comparisons
  - “Mathias” != “Lux” … checks addresses!

Bit Operators

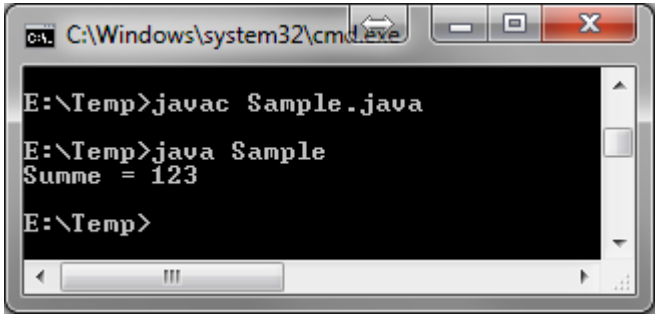
- Bits of operands are modified
  - Example(Java uses two‘s complement)
    - `byte a = 17;  // 00010001`
    - `byte b =  7;  // 00000111`
- Supported operations
  - Disjunction:
    - `byte or = a | b;  // 23`
  - Conjunction:
    - `byte and = a & b; //  1`
  - Antivalence:
    - `byte xor = a ^ b; // 22`
  - Complement:
    - `byte notB = ~b;  // -8`

Java-Programs

```
class ProgramName {
    public static void main (String[] arg) {
        ... // Declarations
        ... // Statements
    }
}

// Example:
class Sample {
    public static void main (String[] arg) {
        int a = 23;
        int b = 100;
        System.out.print("Sum = ");
        System.out.println(a + b);
    }
}
```

Text has to be in file named *ProgramName.java*



Compile and Run with JDK

- Compile
  - `C:\> cd MySamples`
    change to source file
  - `C:\MySamples> javac Sample.java`
    create class file (compile)
- Execute
  - `C:\MySamples> java Sample`
    run class file
  - `Sum = 123`

Example: IDEA IDE

- Strings, comments and variables
  - Spell check, consistency, type check
- Live Templates
  - psvm + <tab>
- Automated naming of Variables
  - <Strg>-<Space>