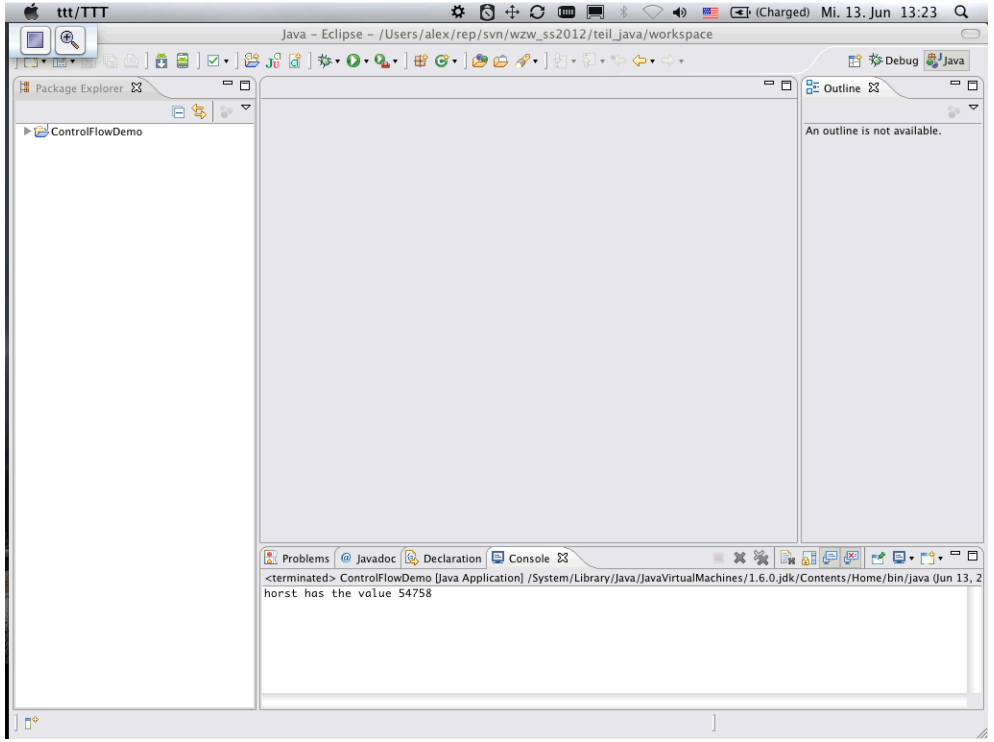
Script **generated by TTT**

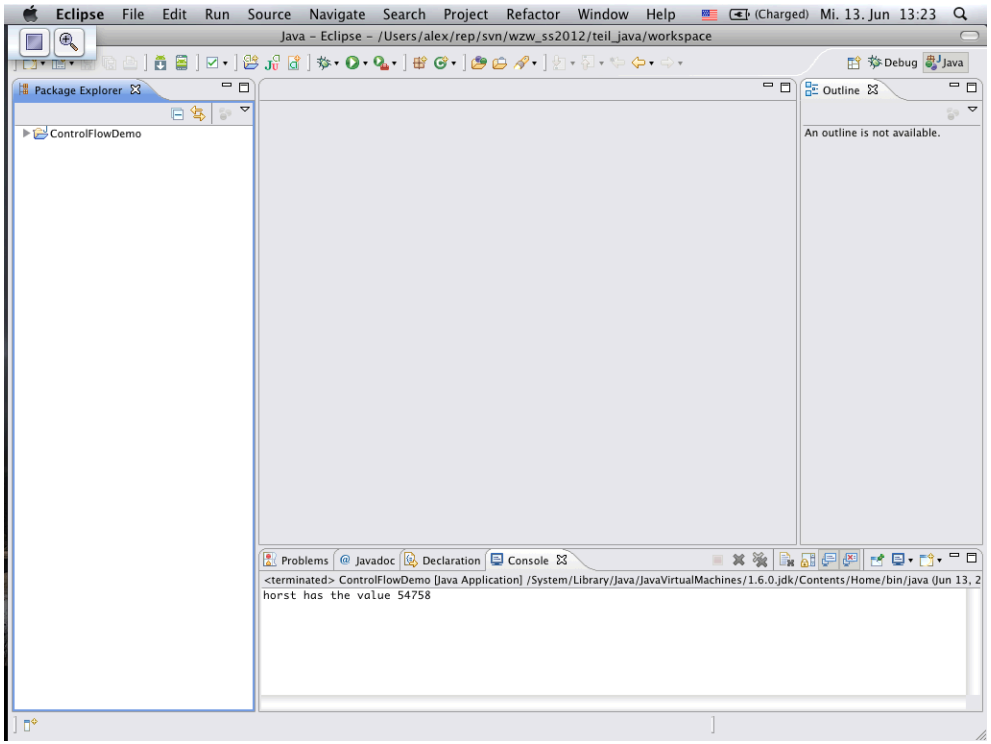
Title: Lehmann: Uebung_Einf_HF (08.06.2012) 2v2

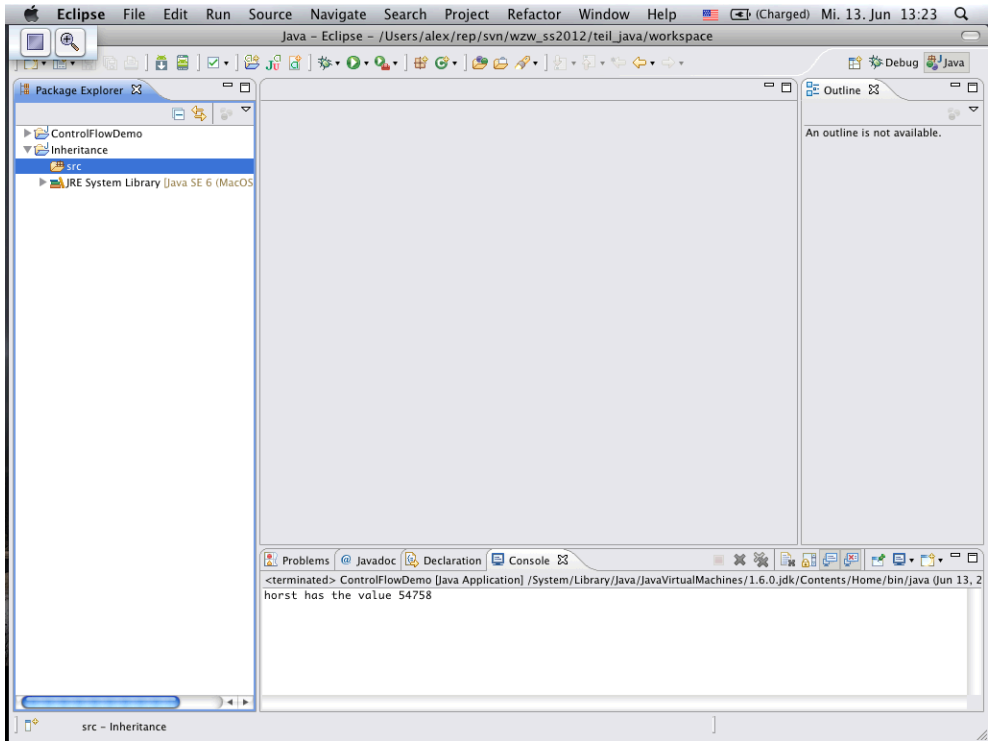
Date: Wed Jun 13 13:23:02 CEST 2012

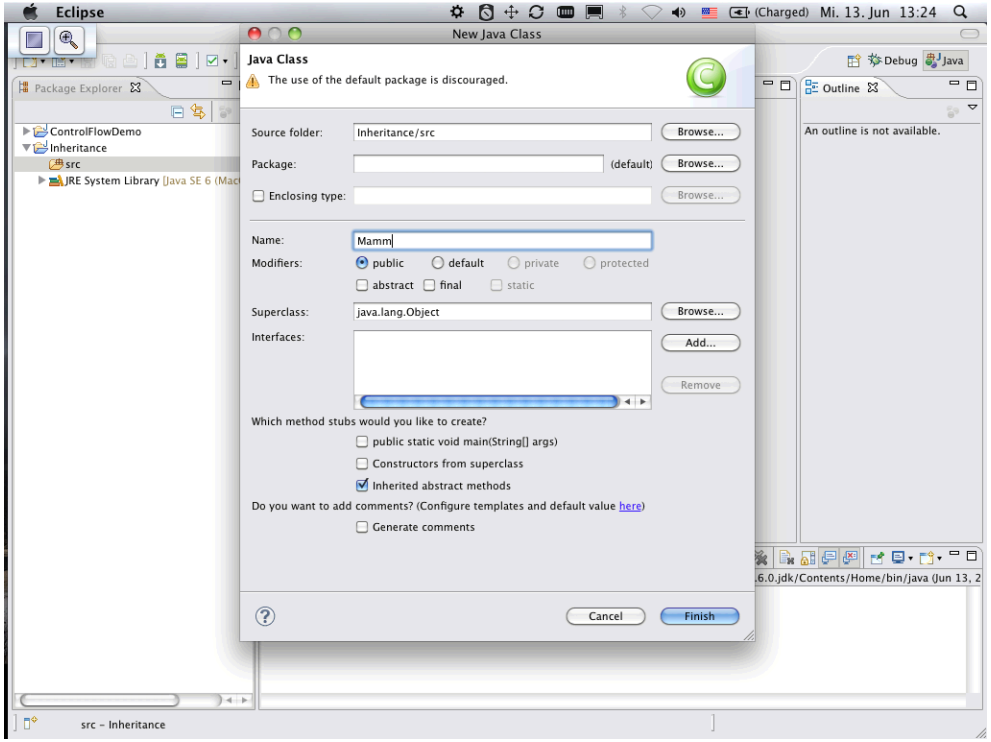
Duration: 47:10 min

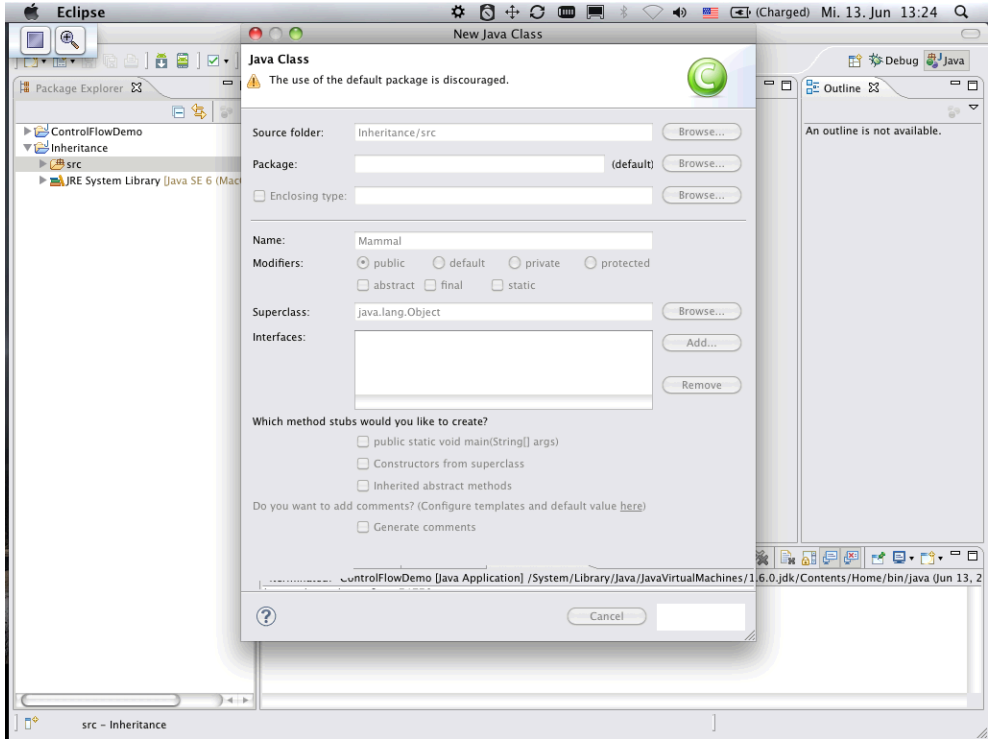
Pages: 41

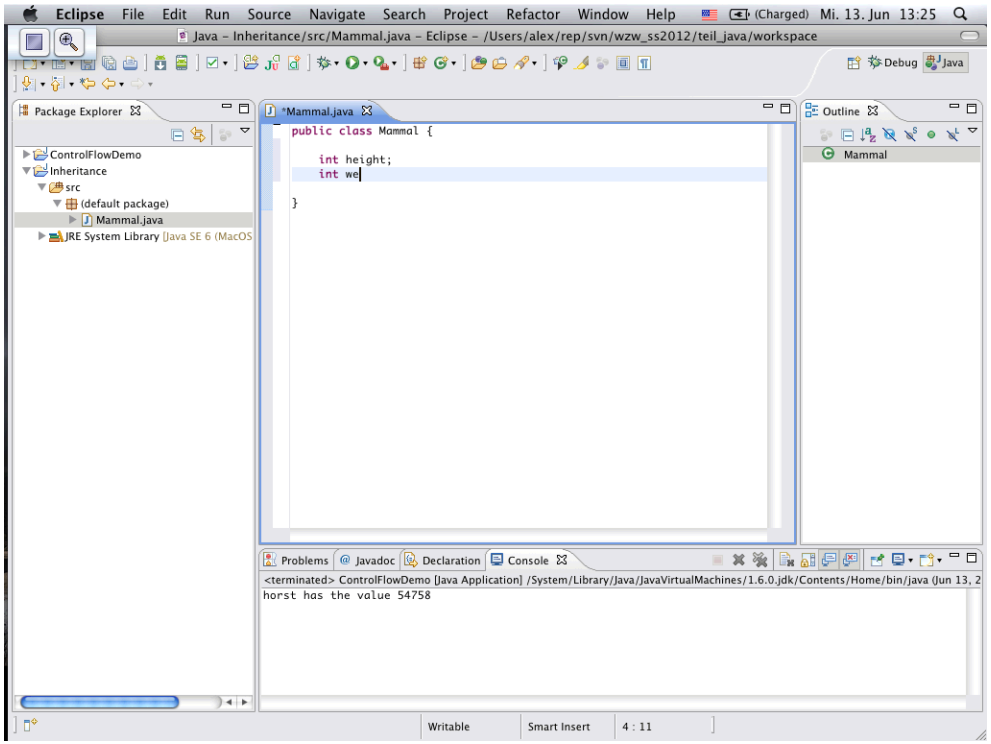


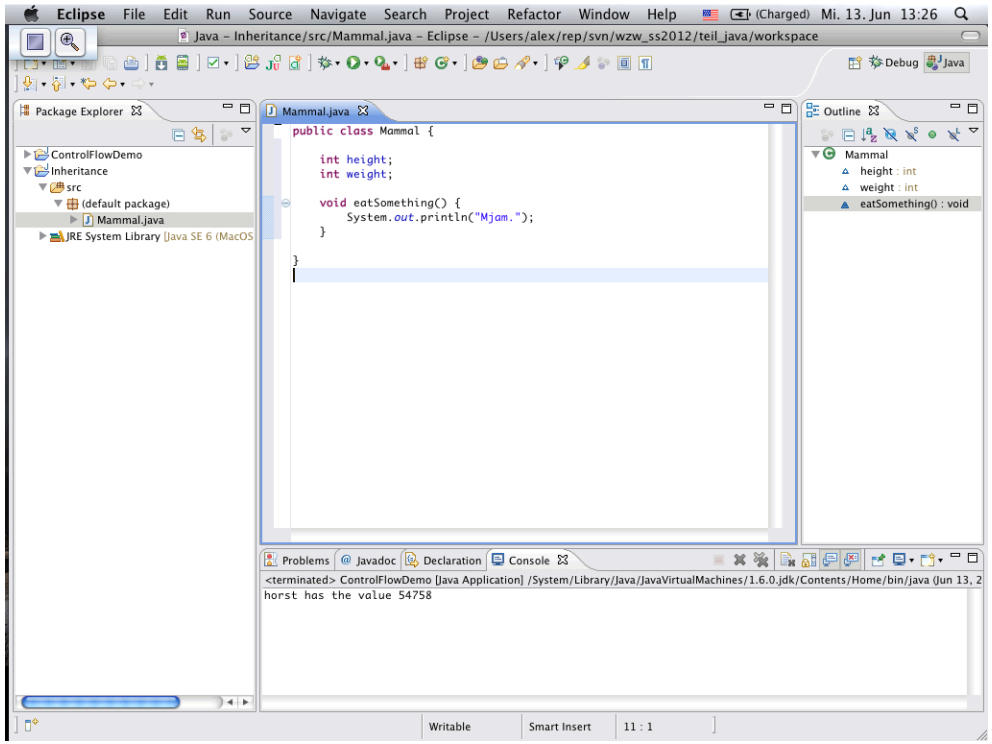


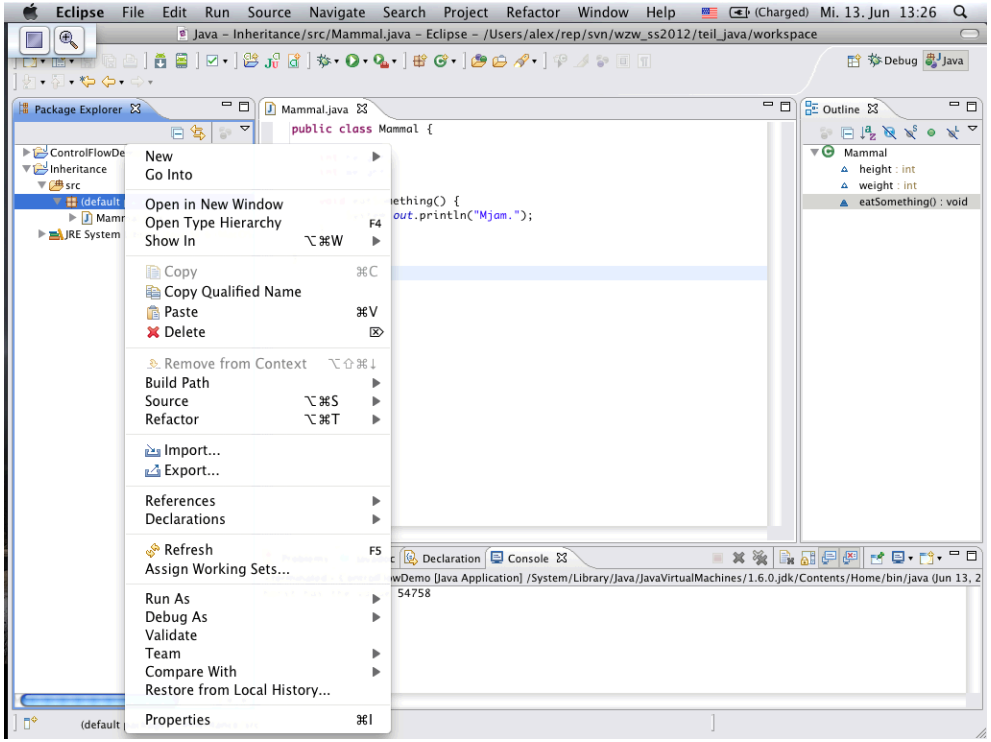


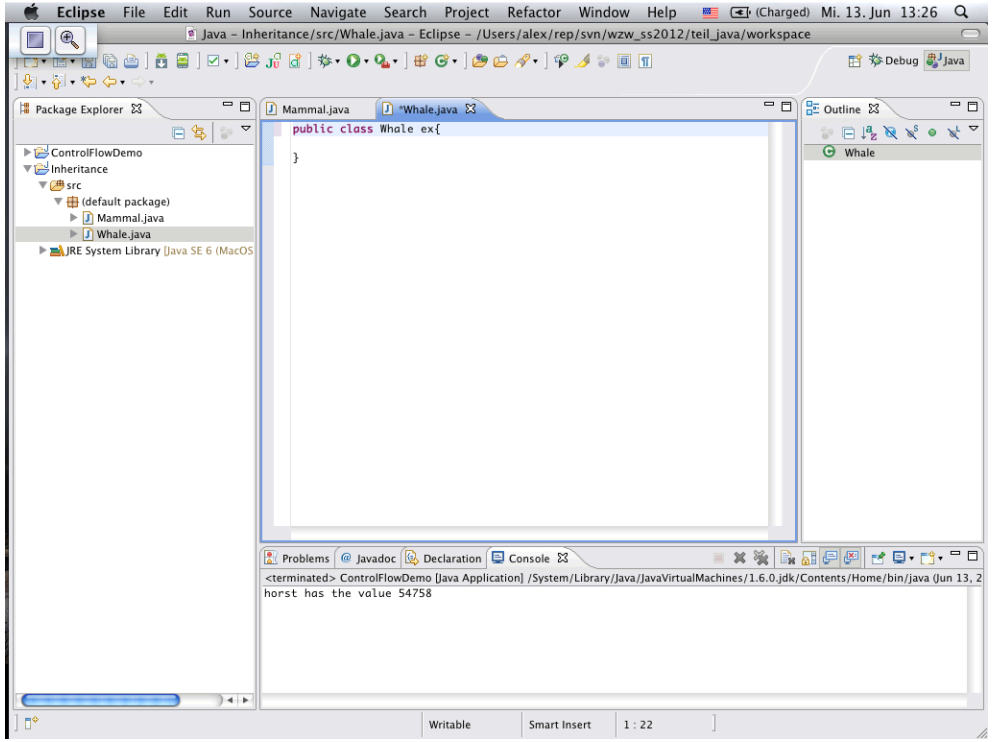

Eclipse
(Charged) Mi. 13. Jun 13:24
New Java Class
Java Class
The use of the default package is discouraged.
Source folder: Inheritance/src
Package: (default)
Enclosing type:
Name: Mamm
Modifiers: public default private protected
abstract final static
Superclass: java.lang.Object
Interfaces:
Add...
Remove
Which method stubs would you like to create?
public static void main(String[] args)
Constructors from superclass
Inherited abstract methods
Do you want to add comments? (Configure templates and default value here)
Generate comments
Cancel
Finish
Package Explorer
ControlFlowDemo
Inheritance
src
JRE System Library [Java SE 6 (Mac
Outline
An outline is not available.
Debug
Java
src – Inheritance

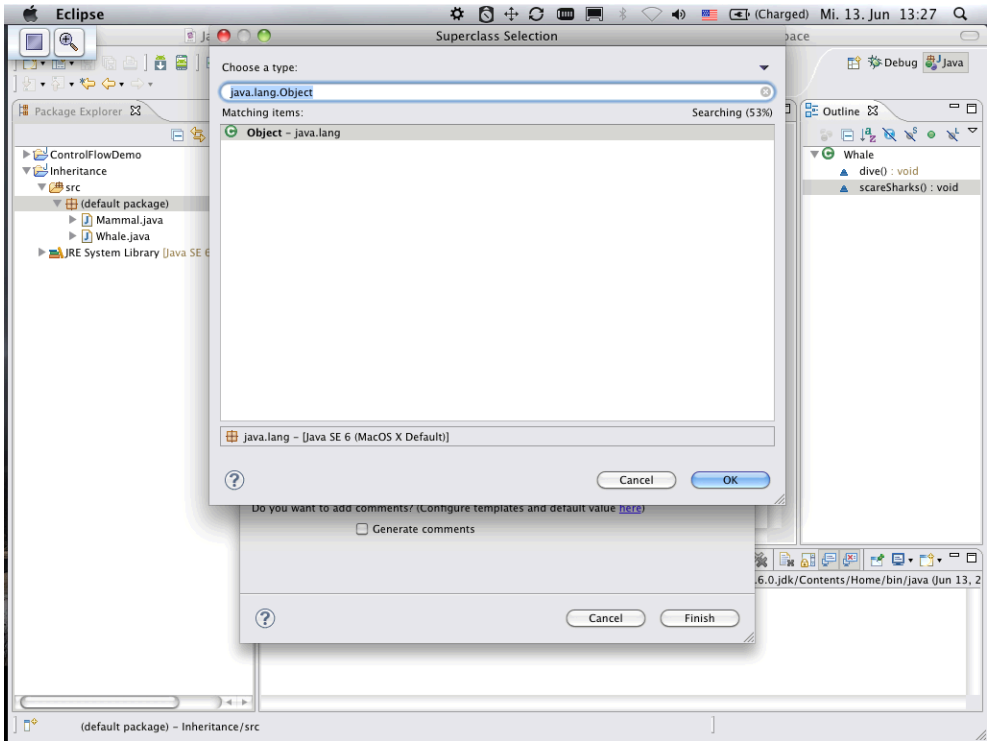

Eclipse
(Charged) Mi. 13. Jun 13:24
New Java Class
Java Class
The use of the default package is discouraged.
Source folder: Inheritance/src
Package: (default)
Enclosing type:
Name: Mammal
Modifiers: public default private protected
abstract final static
Superclass: java.lang.Object
Interfaces:
Add...
Remove
Which method stubs would you like to create?
public static void main(String[] args)
Constructors from superclass
Inherited abstract methods
Do you want to add comments? (Configure templates and default value here)
Generate comments
Cancel
Package Explorer
ControlFlowDemo
Inheritance
src
JRE System Library [Java SE 6 (Mac
Outline
An outline is not available.
Debug
Java
src – Inheritance

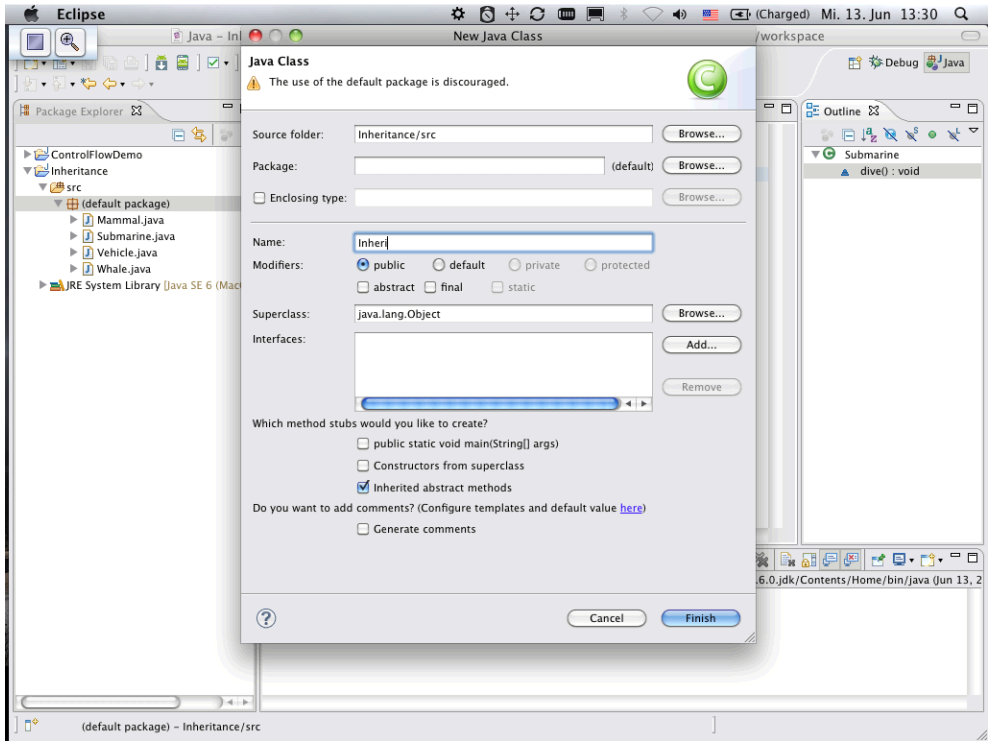

Eclipse File Edit Run Source Navigate Search Project Refactor Window Help
(Charged) Mi. 13. Jun 13:25
Java – Inheritance/src/Mammal.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Package Explorer
ControlFlowDemo
Inheritance
src
(default package)
Mammal.java
JRE System Library [Java SE 6 (MacOS
*Mammal.java
public class Mammal {
int height;
int we
}
Outline
Mammal
Problems
Javadoc
Declaration
Console
<terminated> ControlFlowDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2
horst has the value 54758
Writable
Smart Insert
4 : 11
Debug
Java

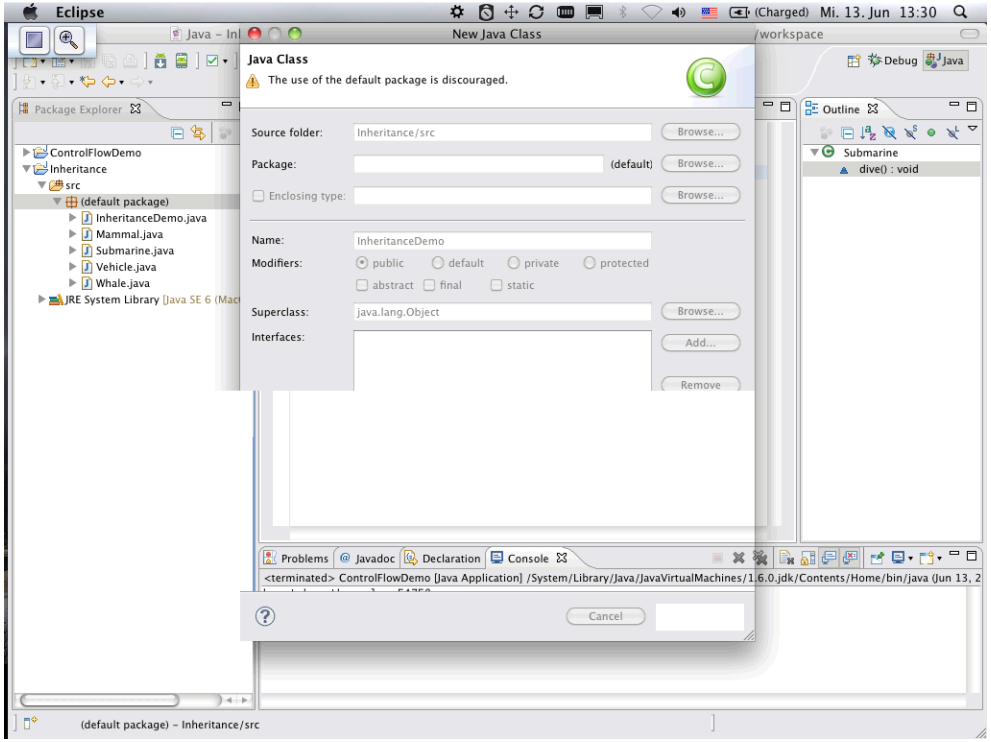

Eclipse File Edit Run Source Navigate Search Project Refactor Window Help
(Charged) Mi. 13. Jun 13:26
Java – Inheritance/src/Mammal.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Package Explorer
ControlFlowDemo
Inheritance
src
(default package)
Mammal.java
JRE System Library [Java SE 6 (MacOS
Mammal.java
public class Mammal {
int height;
int weight;
void eatSomething() {
System.out.println("Mjam.");
}
}
Outline
Mammal
height : int
weight : int
eatSomething() : void
Problems
Javadoc
Declaration
Console
<terminated> ControlFlowDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2
horst has the value 54758
Writable
Smart Insert
11 : 1
Debug
Java

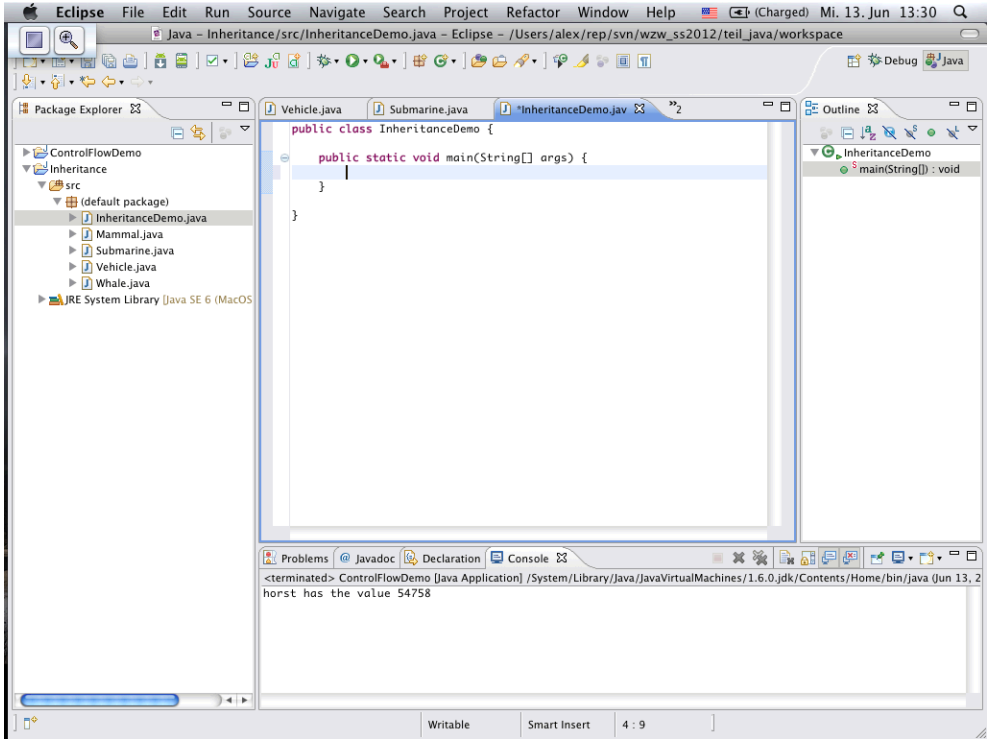

Eclipse File Edit Run Source Navigate Search Project Refactor Window Help
Java – Inheritance/src/Mammal.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Package Explorer
Mammal.java
public class Mammal {
Outline
Mammal
height : int
weight : int
eatSomething() : void
New
Go Into
Open in New Window
Open Type Hierarchy F4
Show In ⌥⌘W
Copy ⌘C
Copy Qualified Name
Paste ⌘V
Delete
Remove from Context ⌥⇧⌘↓
Build Path
Source ⌥⌘S
Refactor ⌥⌘T
Import...
Export...
References
Declarations
Refresh F5
Assign Working Sets...
Run As
Debug As
Validate
Team
Compare With
Restore from Local History...
Properties ⌘I
Declaration
Console
54758

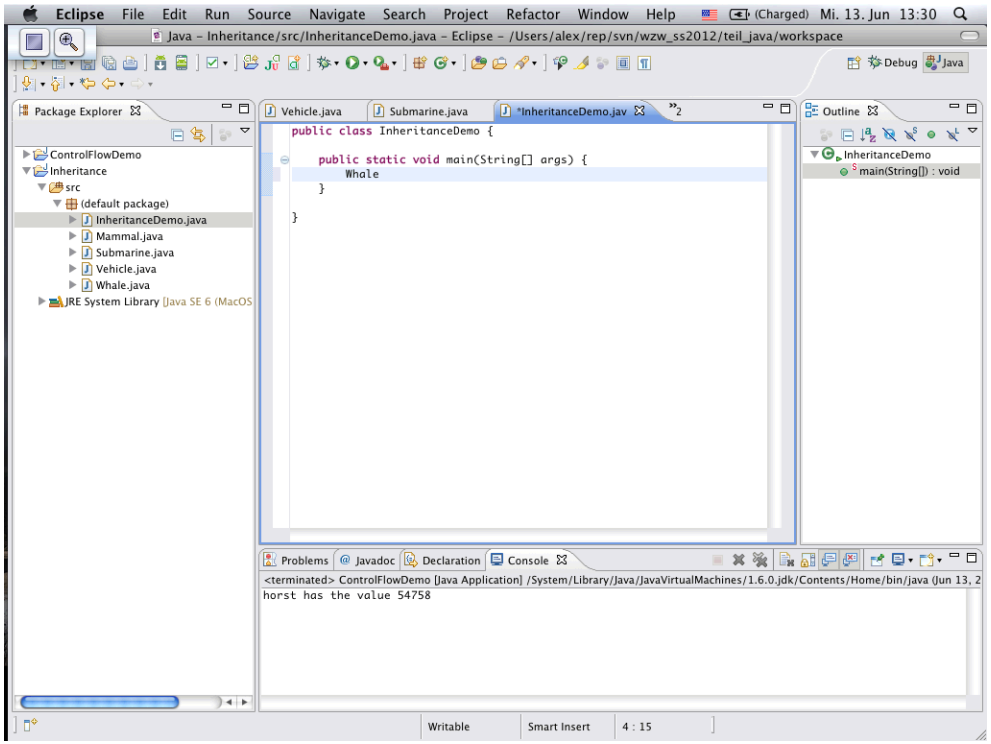

Eclipse File Edit Run Source Navigate Search Project Refactor Window Help
Java – Inheritance/src/Whale.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Package Explorer
Mammal.java
*Whale.java
public class Whale ex{
}
Outline
Whale
Problems
Javadoc
Declaration
Console
horst has the value 54758
Writable
Smart Insert
1 : 22

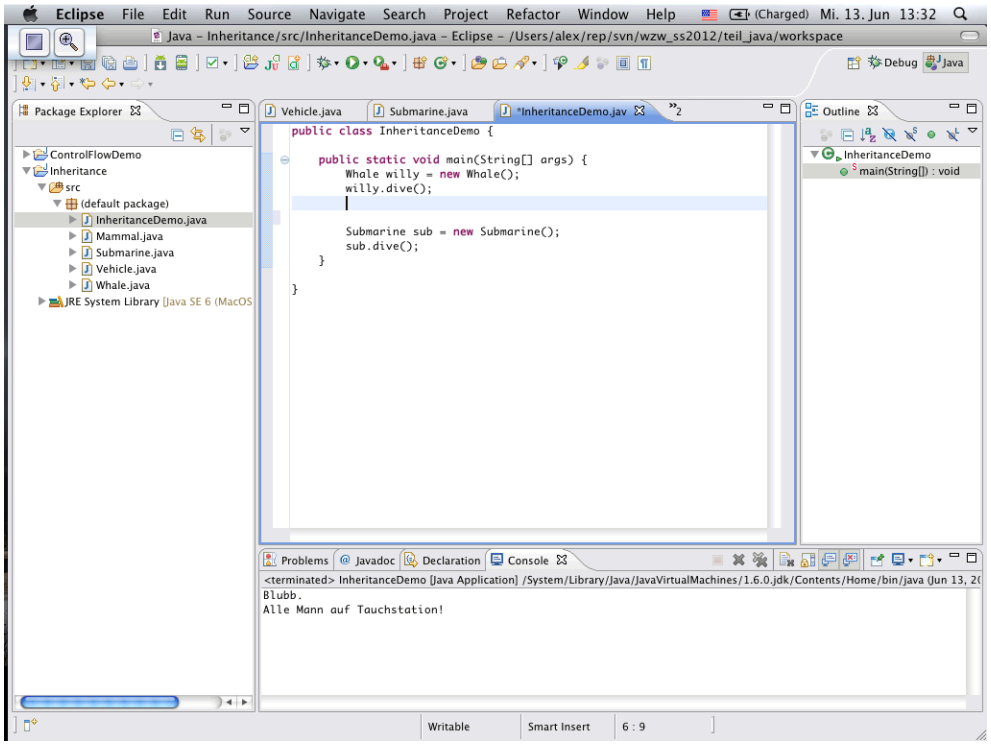

Eclipse
Superclass Selection
Choose a type:
java.lang.Object
Matching items:
Searching (53%)
Object - java.lang
java.lang - [Java SE 6 (MacOS X Default)]
Cancel
OK
Generate comments
Finish
Whale
dive() : void
scareSharks() : void
(default package) - Inheritance/src

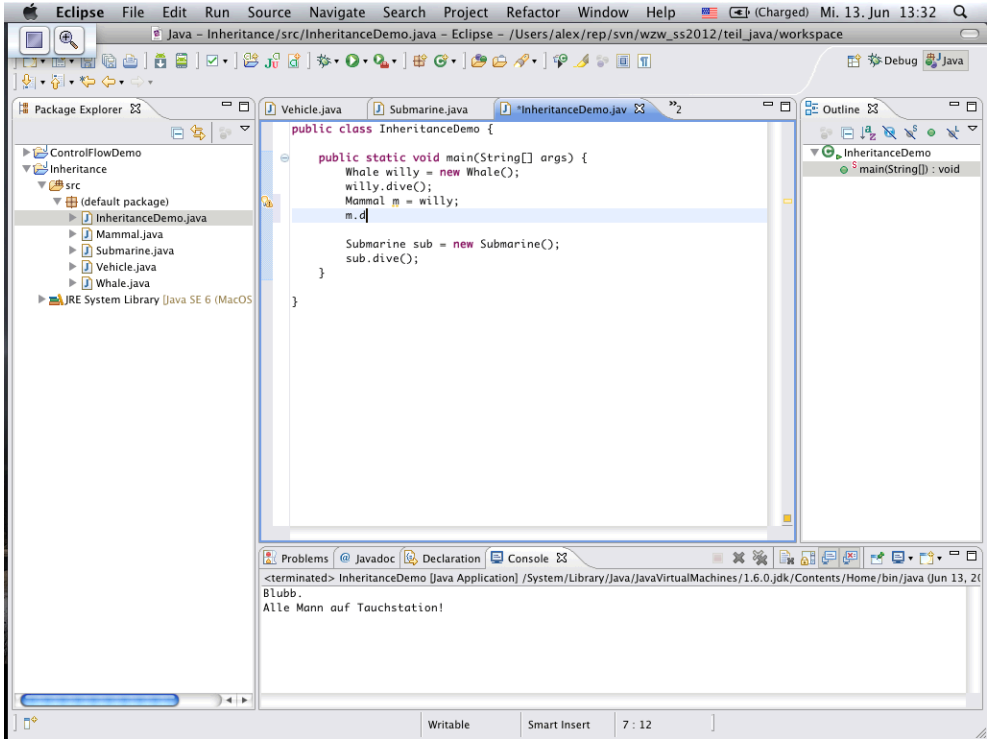

Eclipse
New Java Class
Java Class
The use of the default package is discouraged.
Source folder: Inheritance/src
Package:
Enclosing type:
Name: Inheri
Modifiers: public default private protected
abstract final static
Superclass: java.lang.Object
Interfaces:
Which method stubs would you like to create?
public static void main(String[] args)
Constructors from superclass
Inherited abstract methods
Do you want to add comments? (Configure templates and default value here)
Generate comments
Cancel
Finish
Submarine
dive() : void
(default package) - Inheritance/src

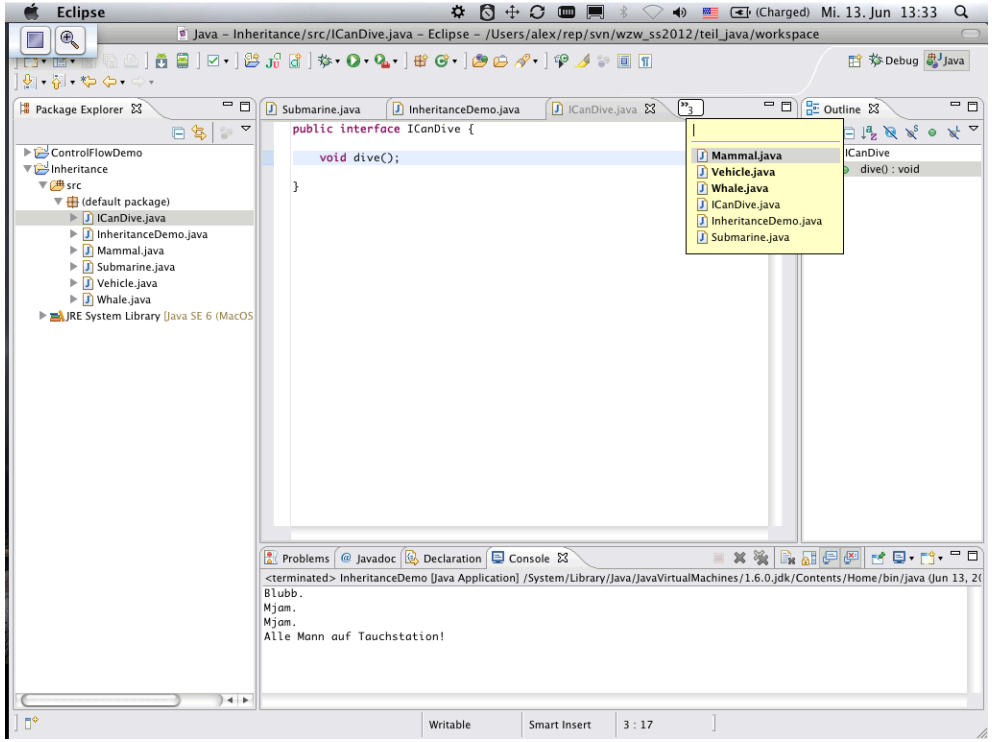

New Java Class
Java Class
The use of the default package is discouraged.
Source folder: Inheritance/src
Package: (default)
Enclosing type:
Name: InheritanceDemo
Modifiers: public default private protected
abstract final static
Superclass: java.lang.Object
Interfaces:
Browse...
Add...
Remove
Cancel
Package Explorer
ControlFlowDemo
Inheritance
src
(default package)
InheritanceDemo.java
Mammal.java
Submarine.java
Vehicle.java
Whale.java
JRE System Library [Java SE 6 (Mac
Outline
Submarine
dive() : void
Problems
Javadoc
Declaration
Console
(default package) - Inheritance/src

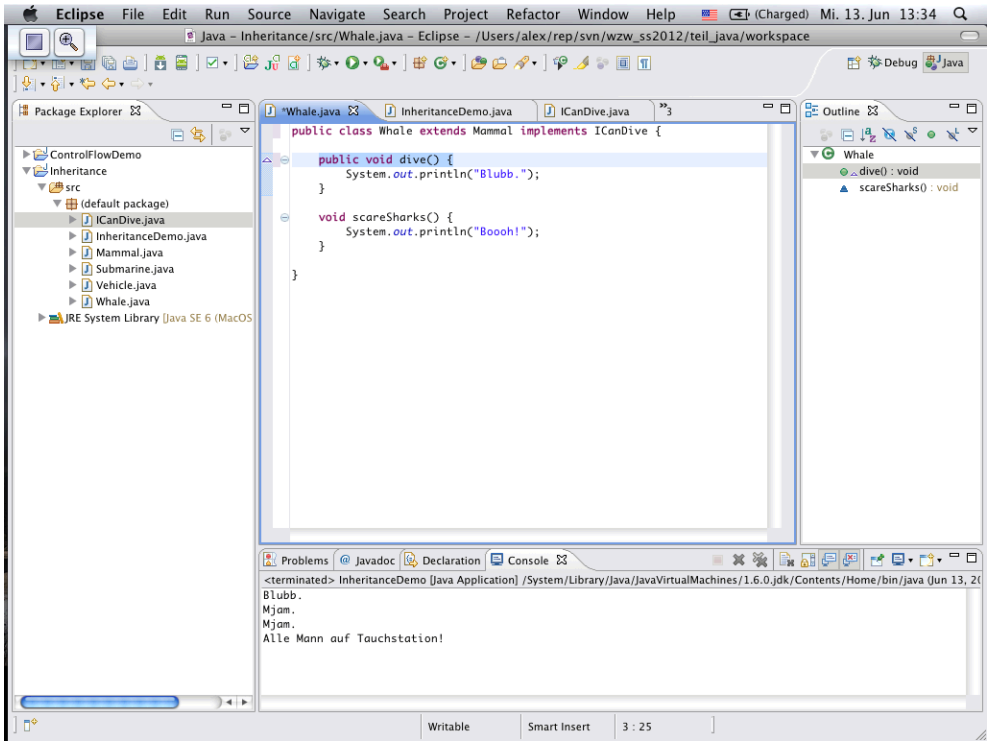

Java - Inheritance/src/InheritanceDemo.java - Eclipse - /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Vehicle.java
Submarine.java
*InheritanceDemo.jav
public class InheritanceDemo {
public static void main(String[] args) {
}
}
Outline
InheritanceDemo
main(String[]) : void
<terminated> ControlFlowDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2
horst has the value 54758
Writable
Smart Insert
4 : 9

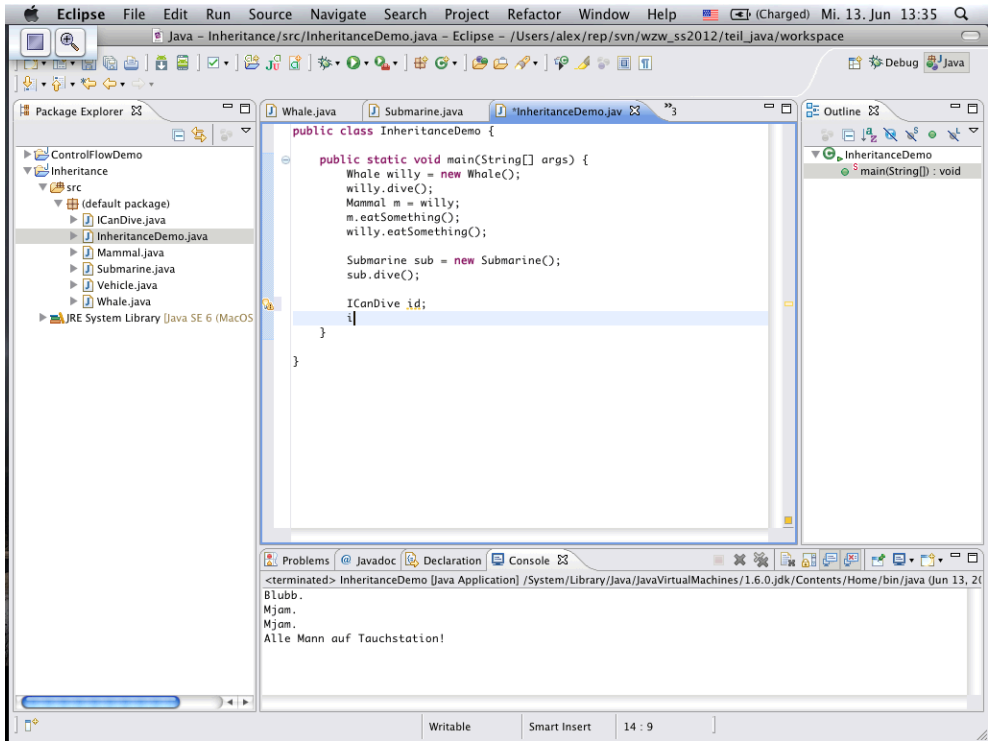

Java - Inheritance/src/InheritanceDemo.java - Eclipse - /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
public class InheritanceDemo {
public static void main(String[] args) {
Whale
}
}
<terminated> ControlFlowDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2
horst has the value 54758
Writable
Smart Insert
4 : 15

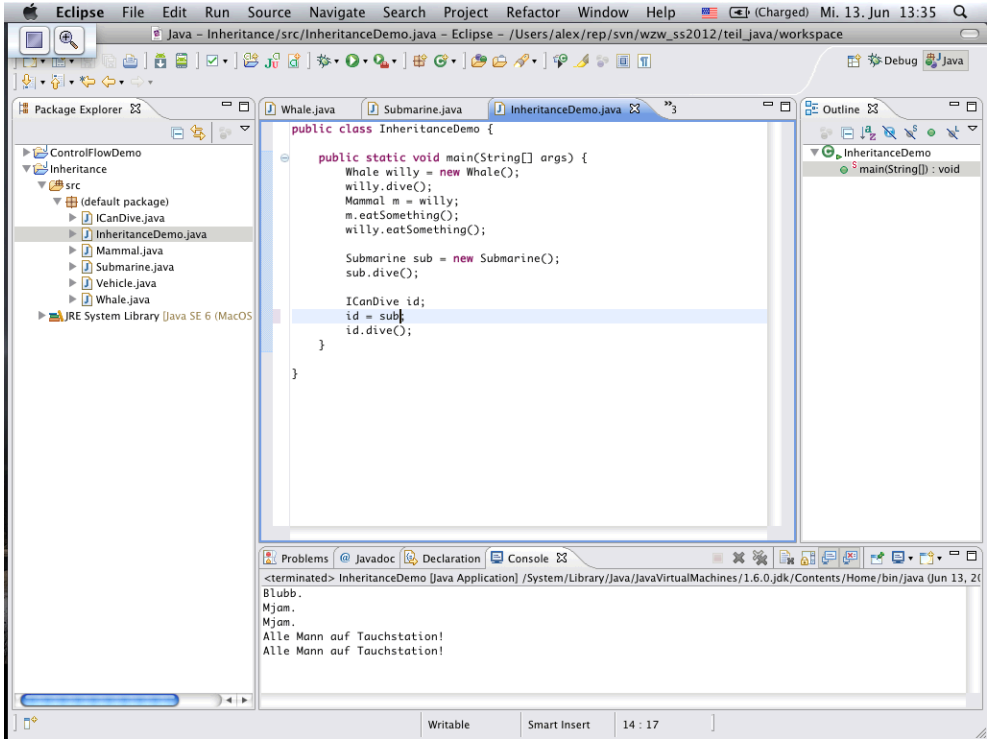

Java - Inheritance/src/InheritanceDemo.java - Eclipse - /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
public class InheritanceDemo {
public static void main(String[] args) {
Whale willy = new Whale();
willy.dive();
Submarine sub = new Submarine();
sub.dive();
}
}
<terminated> InheritanceDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2(
Blubb.
Alle Mann auf Tauchstation!
Writable
Smart Insert
6 : 9

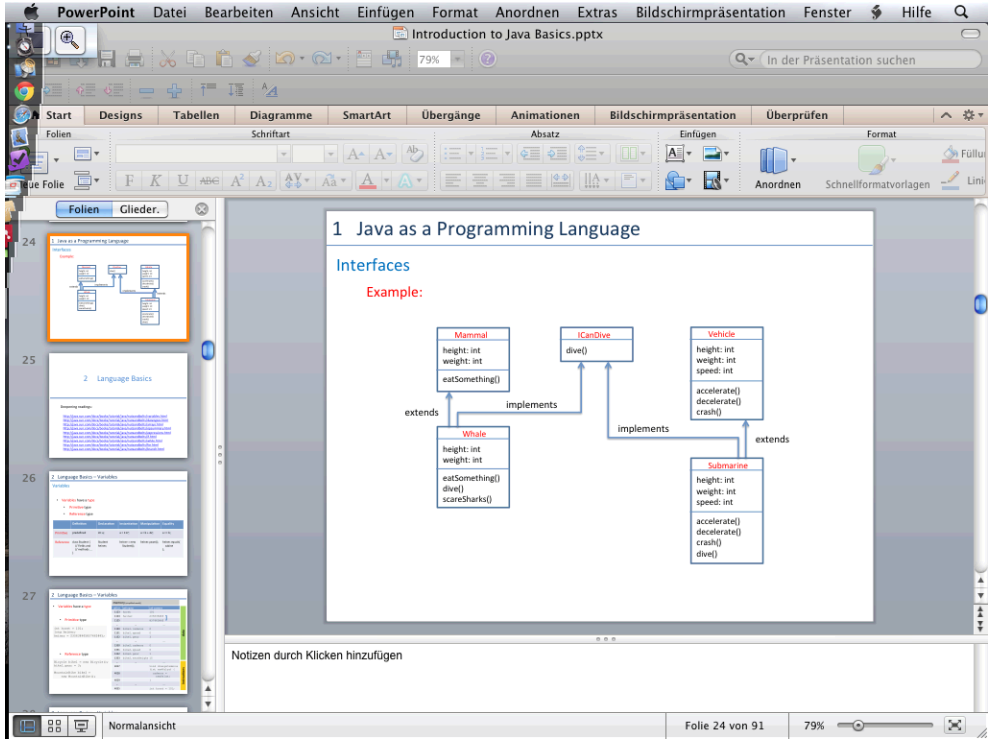

Java – Inheritance/src/InheritanceDemo.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Vehicle.java
Submarine.java
*InheritanceDemo.jav
public class InheritanceDemo {
public static void main(String[] args) {
Whale willy = new Whale();
willy.dive();
Mammal m = willy;
m.d
Submarine sub = new Submarine();
sub.dive();
}
}
InheritanceDemo
main(String[]) : void
ControlFlowDemo
Inheritance
src
(default package)
InheritanceDemo.java
Mammal.java
Submarine.java
Vehicle.java
Whale.java
JRE System Library [Java SE 6 (MacOS
Problems
Javadoc
Declaration
Console
<terminated> InheritanceDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jun 13, 2(
Blubb.
Alle Mann auf Tauchstation!
Writable
Smart Insert
7 : 12


Java – Inheritance/src/ICanDive.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Submarine.java
InheritanceDemo.java
ICanDive.java
public interface ICanDive {
void dive();
}
Mammal.java
Vehicle.java
Whale.java
ICanDive.java
InheritanceDemo.java
Submarine.java
ICanDive
dive() : void
Blubb.
Mjam.
Mjam.
Alle Mann auf Tauchstation!
Writable
Smart Insert
3 : 17


Java – Inheritance/src/Whale.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
*Whale.java
InheritanceDemo.java
ICanDive.java
public class Whale extends Mammal implements ICanDive {
public void dive() {
System.out.println("Blubb.");
}
void scareSharks() {
System.out.println("Boooh!");
}
}
Whale
dive() : void
scareSharks() : void
Blubb.
Mjam.
Mjam.
Alle Mann auf Tauchstation!
Writable
Smart Insert
3 : 25


Java – Inheritance/src/InheritanceDemo.java – Eclipse – /Users/alex/rep/svn/wzw_ss2012/teil_java/workspace
Whale.java
Submarine.java
*InheritanceDemo.jav
public class InheritanceDemo {
public static void main(String[] args) {
Whale willy = new Whale();
willy.dive();
Mammal m = willy;
m.eatSomething();
willy.eatSomething();
Submarine sub = new Submarine();
sub.dive();
ICanDive id;
i
}
}
InheritanceDemo
main(String[]) : void
Blubb.
Mjam.
Mjam.
Alle Mann auf Tauchstation!
Writable
Smart Insert
14 : 9





nguage Basics – Variables

Variables

- Variables have a type
  - Primitive type
  - Reference type

	Definition	Declaration	Instantiation	Manipulation	Equality
Primitive	predefined	int a;	a = 117;	a = b + 42;	a == b;
Reference	class Student { // Fields and // methods ... }	Student heiner;	heiner = new Student();	heiner.yawn();	heiner.equals(sabine);

nguage Basics – Variables

- Variables have a type
  - Primitive type

```
int horst = 101;
long heiner;
heiner = 235638465837465845;
```

  - Reference type

```
Bicycle bike1 = new Bicycle();
bike1.gear = 3;

MountainBike bike2 =
    new MountainBike();
```

memory (simplified model)

cell nr.	cell name	cell content	
1123	horst	101	data
1124	heiner	235638465	data
1125		837465845	data
...	...	...	
1150	bike1.cadence	0	
1151	bike1.speed	0	
1152	bike1.gear	3	
...	...	...	
1330	bike2.cadence	0	
1331	bike2.speed	0	
1332	bike2.gear	1	
1333	bike2.seatHeight	15	
...	...	...	
4027		void changeCadence (int newValue) {	instructions
4028		cadence = newValue;	instructions
4029		}	instructions
...	...	...	
4035		int horst = 101;	instructions

nguage Basics – Variables

Primitive Types

- Primitive types (numeric):

byte	short	int	long	float	double
8 bit	16 bit	32 bit	64 bit	32 bit	64 bit

- Examples:

```
byte flags = 63;
short bbb  = 10133;
int heiner = 234103234;
long dong  = -83628735682345;
float fff  = 5464.00345;
float ggg  = -345545.34534E-12f;
double sss = 3245343455.555E67;
```

= -345545.34534 * 10^{-12}

= 3245343455.555 * 10^{67}

nguage Basics – Variables

- Primitive types (numeric, boolean, character):

$\in \mathbb{Z}$ (byte, short, int, long) $\in \mathbb{R}$ (float, double) Unicode (UTF-16) (char)

byte	short	int	long	float	double	boolean	char
8 bit	16 bit	32 bit	64 bit	32 bit	64 bit	1 bit	16 bit
$[-2^7, 2^7-1]$ = [-128,127]	$[-2^{15}, 2^{15}-1]$ = [-32768,32767]	$[-2^{31}, 2^{31}-1]$ = [-2147483648, 2147483647]	$[-2^{63}, 2^{63}-1]$ = [-9223372036854775808, 9223372036854775807]	[+/- ~ $1.4*10^{-45}$, +/- ~ $3.4*10^{38}$]	[+/- ~ $4.9*10^{-324}$, +/- ~ $1.8\ 10^{308}$]	{ true, false }	{ … !, „, §, $, %, &, …., a, b, c, …., ∭,…., ﬃ,….,≎ , ガ,キ,ギ,…., ㋗,㋘,㋙,…., 樵,樶,蕺,… 액,앴, 앤…,ڜڜ, …., →,↓,■, …}

nguage Basics – Variables

- Primitive types (numeric, boolean, character):

$\in \mathbb{Z}$ (byte, short, int, long) $\in \mathbb{R}$ (float, double) Unicode (UTF-16) (char)

byte	short	int	long	float	double	boolean	char
8 bit	16 bit	32 bit	64 bit	32 bit	64 bit	1 bit	16 bit
$[-2^7, 2^7-1]$ = [-128,127]	$[-2^{15}, 2^{15}-1]$ = [-32768,32767]	$[-2^{31}, 2^{31}-1]$ = [-2147483648, 2147483647]	$[-2^{63}, 2^{63}-1]$ = [-9223372036854775808, 9223372036854775807]	[+/- ~ $1.4*10^{-45}$, +/- ~ $3.4*10^{38}$]	[+/- ~ $4.9*10^{-324}$, +/- ~ $1.8\ 10^{308}$]	{ true, false }	{ … !, „, §, $, %, &, …., a, b, c, …., ∭,…., ﬃ,….,≎ , ガ,キ,ギ,…., ㋗,㋘,㋙,…., 樵,樶,蕺,… 액,앴, 앤…,ڜڜ, …., →,↓,■, …}

nguage Basics – Variables

- More examples:

```
byte flags = 63;
short bbb  = 10133;
int heiner = 234103234;
long dng   = -83628735682345;
float fff  = 5464.00345f;
float ggg  = -345545.34534E-12f;
double sss = 3245343455.555E67d;

char ccc   = 'm';
char ccc2  = '\n';

boolean isCool = true;
```

byte typically used for bit-patterns

= -345545.34534 * 10^{-12} (float)

= 3245343455.555 * 10^{67} (double)

`\n` means "new line"

nguage Basics – Variables

Reference Type Variables

- Reference type variables "point" to an object of the reference type

```
bike1 = new Bicycle();
bike2 = new Bicycle();




boolean c;
c = bike1.equals(bike2);
    // c == true
c = (bike1 == bike2);
    // c == false
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	bike1	<1150>
1150	bike1.cadence	0
1151	bike1.speed	0
1152	bike1.gear	1
...	...	...
1327	bike2	<1405>
...	...	...
1405	bike2.cadence	0
1406	bike2.speed	0
1407	bike2.gear	1
...	...	...

data

nguage Basics – Variables

Reference Type Variables

- Reference type variables "point" to an object of the reference type

```
bike1 = new Bicycle();
bike2 = new Bicycle();


bike1.gear = 3;


boolean c;
c = bike1.equals(bike2);
    // c == true
c = (bike1 == bike2);
    // c == false
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	bike1	<1150>
1150	bike1.cadence	0
1151	bike1.speed	0
1152	bike1.gear	3
...	...	...
1327	bike2	<1405>
...	...	...
1405	bike2.cadence	0
1406	bike2.speed	0
1407	bike2.gear	1
...	...	...

data

nguage Basics – Variables

Reference Type Variables

- Reference type variables "point" to an object of the reference type

```
bike1 = new Bicycle();
bike2 = new Bicycle();


bike1.gear = 3;


bike1 = bike2;


boolean c;
c = bike1.equals(bike2);
    // c == true
c = (bike1 == bike2);
    // c == true
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	bike1	<1405>
1150	bike1.cadence	0
1151	bike1.speed	0
1152	bike1.gear	3
...	...	...
1327	bike2	<1405>
...	...	...
1405	bike2.cadence	0
1406	bike2.speed	0
1407	bike2.gear	1
...	...	...

data

nguage Basics – Variables

Reference Type Variables

- Reference type variables "point" to an object of the reference type

```
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bike1.gear = 3;


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...	...	...
1327	bike2	<1405>
...	...	...
1405	bike2.cadence	0
1406	bike2.speed	0
1407	bike2.gear	1
...	...	...

data

nguage Basics – Variables

Reference Type Variables

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memory (simplified model)

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...	...	...
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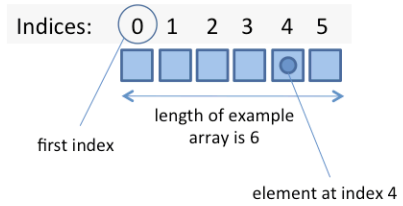
...	...	...
1405	bike2.cadence	0
1406	bike2.speed	0
1407	bike2.gear	1
...	...	...

data

nguage Basics – Variables

Arrays

- Array: "Indexed list" of elements
- Holds a fixed number of variables of a certain type (primitive or reference)
- Is itself a reference type (see next slide)




```
int[] someArray;
someArray = new int[6];
someArray[0] = 23;
someArray[1] = 12;
someArray[5] = 4 + someArray[2];

String[] someOtherArray;
someOtherArray = new String[30];
someOtherArray[17] = "bla bla";

AnyClass[] thirdArray;
thirdArray = new AnyClass[45];
thirdArray[44] = new AnyClass();
thirdArray[44].someMethod();
```

array of *primitive type* elements

array of *reference type* elements (objects)

nguage Basics – Variables

Arrays

- Array is itself a reference type:

```
int[] someArray = new int[3];
int[] anotherArray = new int[3];

someArray[2] = 7;
anotherArray[1] = 8;
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	someArray	<1150>
1150		0
1151		0
1152		7
...	...	...
1327	anotherArray	<1328>
1328		0
1329		8
1330		0
...	...	...

nguage Basics – Variables

Arrays

- Array is itself a reference type:

```
int[] someArray = new int[3];
int[] anotherArray = new int[3];

someArray[2] = 7;
anotherArray[1] = 8;

someArray = anotherArray;

boolean b = (someArray[1] == 8);
// b == true
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	someArray	<1328>
1150		0
1151		0
1152		7
...	...	...
1327	anotherArray	<1328>
1328		0
1329		8
1330		0
...	...	...

nguage Basics – Variables

Arrays

- Array is itself a reference type:

```
int[] someArray = new int[3];
int[] anotherArray = new int[3];

someArray[2] = 7;
anotherArray[1] = 8;

someArray = anotherArray;

boolean b = (someArray[1] == 8);
// b == true
```

- Length property:

```
int l = someArray.length;
// l == 3
```

memory (simplified model)

cell nr	cell name	cell content
...	...	...
1149	someArray	<1328>
1150		0
1151		0
1152		7
...	...	...
1327	anotherArray	<1328>
1328		0
1329		8
1330		0
...	...	...

nguage Basics – Operators

Operators

- Operators (mostly) act on variables of primitive types. Examples:

Assignment Operator

=	Simple assignment operator (also for reference types)	`a = b+1; bike2 = bike1.copy();`

Arithmetic Operators

+	Additive operator	`double aaa = b + 1.7;  int a = 1 + 1;`
-	Subtraction operator	`int b = c - 9;  float f = 10.0f - 23.0f;`
*	Multiplication operator	`fd = fd * 0.1f;  double d = z * z;`
/	Division operator	`int a = 17 / 9  // a == 1;` `float eee = 13.0f / 2.0f  // ee == 6.5f;`
%	Remainder operator	`int a = 17 % 9  // a == 8;`

Unary Operators

+	Unary plus operator; (not very useful)	`int a = -1; int b = +a;  // b == -1`
-	Unary minus operator; negates an expression	`int a = -1; int b = -a;  // b == 1`
++	Increment by 1	`int a = 0; a++;  // a == 1;`
--	Decrement by 1	`int a = 1; a--;  // a == 0;`
!	Inverse value of a boolean	`boolean b = true; c = !b; // c==false;`

nguage Basics – Operators

Equality and Relational Operators

==	Equal to	`boolean a = (1 == 1);  // a == true`
!=	Not equal to	`boolean a = (1 != 1);  // a == false`
>	Greater than	`boolean a = (17 > 12));  // a = true;`
>=	Greater than or equal to	etc.
<	Less than	
<=	Less than or equal to	

Conditional Operators

&&	Conditional-AND	`a = false; b = true; c = a && b;  // c == false;`
||	Conditional-OR	`a = false; b = true; c = a || b;  // c == true;`
?:	Ternary (shorthand for if-then-else statement, use `if-then-else` instead!)	

Reference Type Comparison Operator

instanceof	Compares an object to a specified type

```
Vector z = new Vector();
boolean b =
    z.instanceOf(Vector);
// b== true;
```

Bitwise and Bit Shift Operators

(not that important for us; see URL below)

http://docs.oracle.com/javase/tutorial/java/nutsandbolts/op3.html

nguage Basics – Operators

- There is a fixed precedence of operators
- Simple: Use brackets "(" ... ")" to enforce precendence as desired!

```
int a = ((7 + 4) * 8) % 3;     // a == 1
```

- Important: Dereference operator for reference types: dot-operator "."

```
String s1 = s1.concatenate(s2);

bike1.cadence = 4;

bike1.changeGear(5);
```

Expressions

- Expression: Legal combination of variables and operators
- Can be (and typically are) nested
- Expressions evaluate to a value that has a type

Example	Evaluates to	Type
`48`	`48`	int
`2.0 / 3.0`	`0.6666666667`	double
`new String("luja sog i")`	`"luja sog i"`	String
`a = (17 + (3 * 9)) % 3)`	`2`	int
`a++`	`2` (but a is now 3)	int
`++a`	`3`	int
`a * 9 / (new String("blue").length())`	`6`	int

nguage Basics – Expressions, Statements, Blocks

Expressions

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`a = (17 + (3 * 9)) % 3)`	`2`	int
`a++`	`2` (but a is now 3)	int
`++a`	`3`	int
`a * 9 / (new String("blue").length())`	`6`	int