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# jasmin JVM Code Examples

Masters in Informatics and Computing Engineering (MIEIC), 3rd Year

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# Outline

- Examples of how Java code is translated to the JVM – uses code that can be input to *jasmin* to generate the classfiles

# jasmin

- "Jasmin is an assembler for the Java Virtual Machine. It takes ASCII descriptions of Java classes, written in a simple assembler-like syntax using the Java Virtual Machine instruction set. It converts them into binary Java class files, suitable for loading by a Java runtime system."
- It is a Java program
- Jasmin: <http://jasmin.sourceforge.net/>

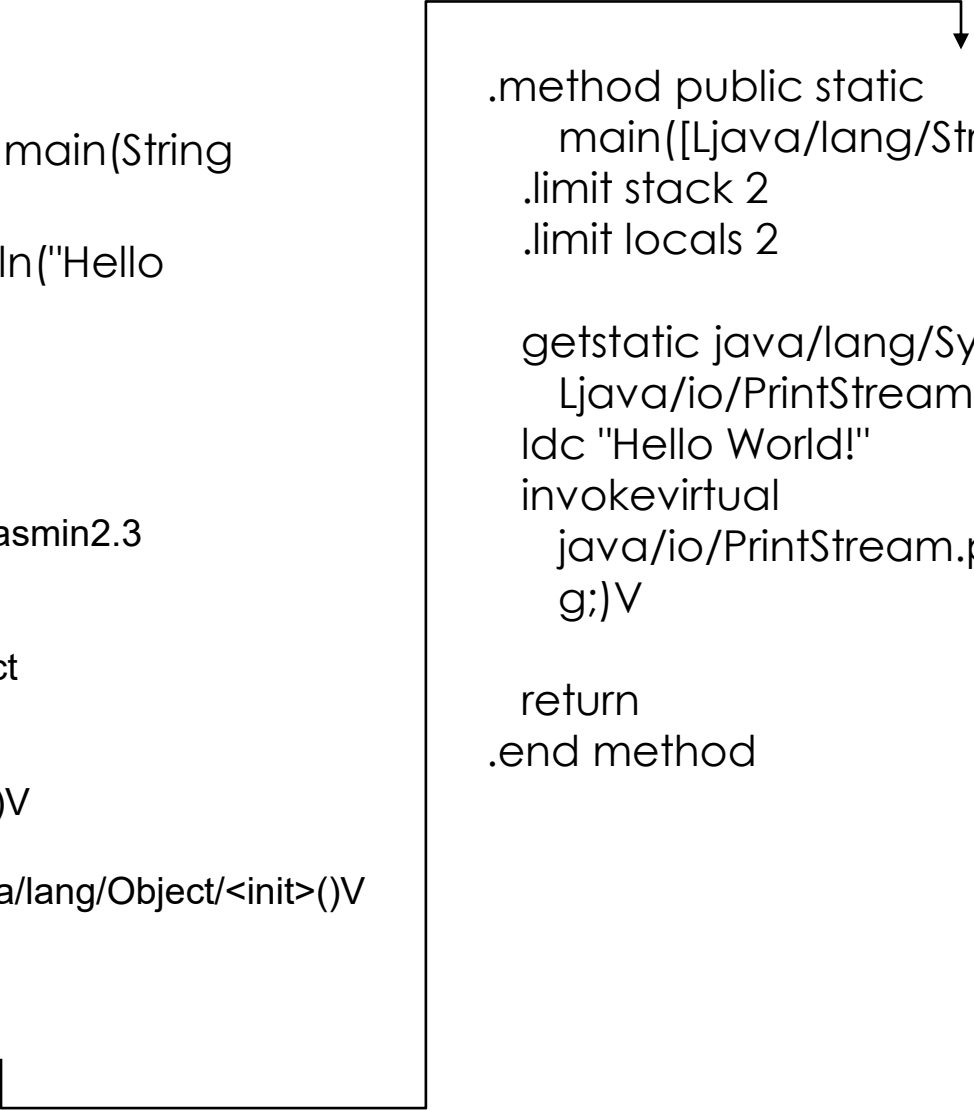
# Hello World!

```
public class Hello {  
    public static void main(String  
        args[]) {  
        System.out.println("Hello  
            World!");  
    }  
}
```

; Classe aceite pelo Jasmin2.3

```
.class public Hello  
.super java/lang/Object
```

```
; standard initializer  
.method public <init>()V  
    aload_0  
    invokenonvirtual java/lang/Object/<init>()V  
    return  
.end method
```



```
.method public static  
    main([Ljava/lang/String;)V  
.limit stack 2  
.limit locals 2  
  
    getstatic java/lang/System.out  
        Ljava/io/PrintStream;  
    ldc "Hello World!"  
    invokevirtual  
        java/io/PrintStream.println(Ljava/lang/Strin  
            g;)V  
  
    return  
.end method
```

# Access to attributes

```
public class fields {  
  
    static int a=20;  
  
    public static void main(String args[]) {  
  
        io.print("Field value: ", a);  
  
        a=10;  
  
        io.print("Field value: ", a);  
    }  
}
```

```
; Classe com sintaxe aceite pelo Jasmin2.3  
  
.class public fields  
.super java/lang/Object  
  
.field static a I = 20  
  
.method public static main([Ljava/lang/String;)V  
    .limit stack 2  
    .limit locals 1  
  
    ldc    " Field value: "  
    getstatic  fields/a I  
    invokestatic  io/print(Ljava/lang/String;)V  
  
    bipush 10  
    putstatic  fields/a I  
  
    ldc    " Field value: "  
    getstatic  fields/a I  
    invokestatic  io/print(Ljava/lang/String;)V  
  
    return  
.end method
```

# Arrays

public class arrays2 {	; Classe aceita pelo Jasmin2.3
static float[] B;	.class public arrays2 .super java/lang/Object
static float[] C = new float[20];	; array B .field static B [F
public static void main(String args[]) {	; array C .field static C [F
B = new float[20];	
int[] A = new int[10];	
	; static code goes here .method static public <clinit>()V .limit stack 2
A[3] = 20;	
for(int i=0; i<10; i++) {	; C = new float[20]; bipush 20 newarray float putstatic arrays2/C [F
io.print("Expr result: ", A[i]);	
}	
}	return .end method

# Arrays (cont.)

```
public class arrays2 {  
    static float[] B;  
  
    static float[] C = new float[20];  
  
    public static void main(String args[]) {  
        B = new float[20];  
        int[] A = new int[10];  
  
        A[3] = 20;  
  
        for(int i=0; i<10; i++) {  
            io.print("Expr result: ", A[i]);  
        }  
    }  
}
```

```
.method public static main([Ljava/lang/String;)V  
    .limit stack 3  
    .limit locals 3  
  
    ; B = new float[20];  
    bipush 20  
    newarray float  
    putstatic arrays2/B [F  
  
    ; int[] A = new int[10];  
    bipush 10  
    newarray int  
    astore_1  
  
    ; A[3] = 20  
    aload_1  
    iconst_3  
    bipush 20  
    iastore
```

# Arrays (cont.)

```
public class arrays2 {  
  
    static float[] B;  
  
    static float[] C = new float[20];  
  
    public static void main(String args[]) {  
        B = new float[20];  
        int[] A = new int[10];  
  
        A[3] = 20;  
  
        for(int i=0; i<10; i++) {  
            io.print("Expr result: ", A[i]);  
        }  
    }  
}
```

```
iconst_0  
istore 2  
  
loop:  
    iload_2  
    bipush 10  
    if_icmpge end_loop  
  
    ldc "Expr result: "  
    aload_1  
    iload_2  
    iaload  
    invokestatic io/print(Ljava/lang/String;I)V  
  
    iinc 2 1  
  
    goto loop  
end_loop:  
  
    return  
    .end method
```



# Functions

```
public class functions {  
  
    public static int square(int  
    a) {  
        return a*a;  
    }  
  
    public static int f(int a) {  
        int b= square(a);  
        return b;  
    }  
}  
  
.class public functions  
.super java/lang/Object
```

```
.method public static square(I)I  
    .limit stack 2  
    .limit locals 1  
  
    iload_0  
    iload_0  
    imul  
  
    ireturn  
  
.end method  
  
.method public static f(I)I  
    .limit stack 1  
    .limit locals 1  
  
    iload_0  
    invokestatic functions.square(I)I  
  
    ireturn  
  
.end method
```

# Functions

```
public class functions {  
  
    public static int square(int  
    a) {  
        return a*a;  
    }  
  
    public static int f(int a) {  
        int b= square(a);  
        return b;  
    }  
    ... // main to print f(10)  
}
```

```
.method public static  
    main([Ljava/lang/String;)V  
    .limit stack 1  
    .limit locals 1  
  
    bipush 10 ; perform the square of 10  
    invokestatic functions.f(I)I  
  
    invokestatic io.print(I)V ; print result  
  
    return  
.end method
```

# Other Examples

- return a reference to an array

```
.method public static f(II)[I
.limit stack 3 ; max=65535
.limit locals 3 ; max=65535

; B = new int[value of first argument];
iload_0
newarray int
astore_2

; B[value of second argument] = 50
aload_2
iload_1
bipush 50
iastore

aload_2
areturn
.end method
```

## Other Examples (cont.)

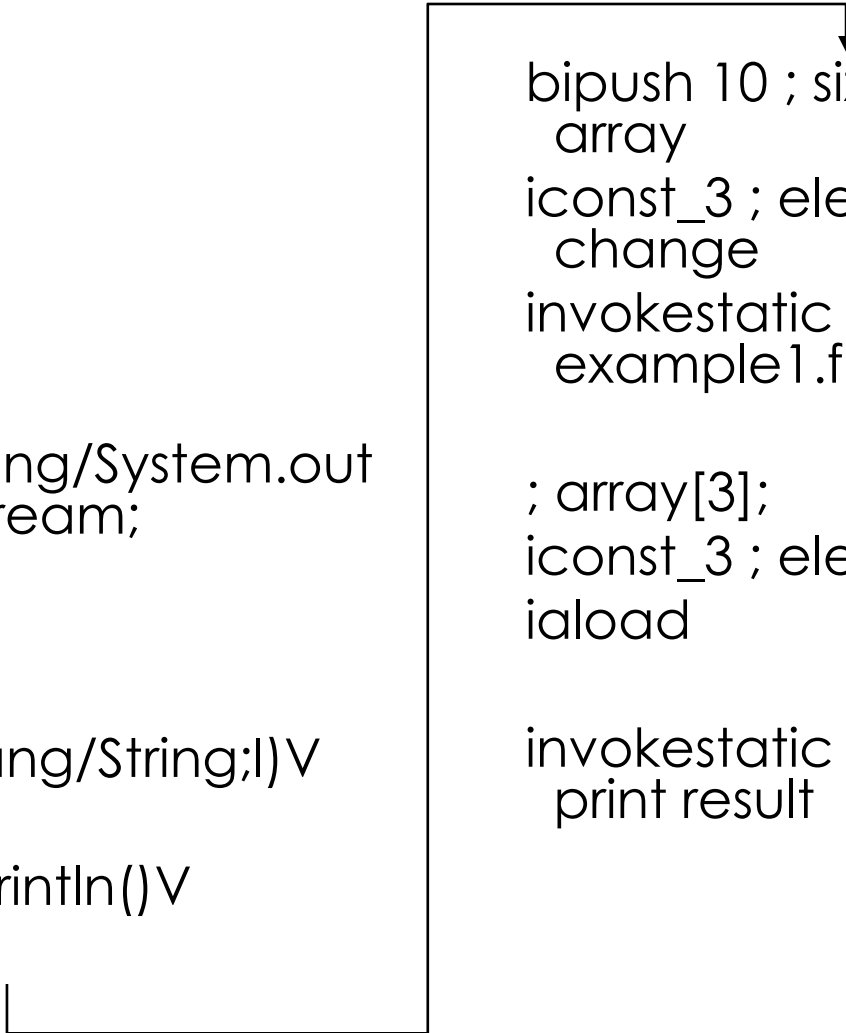
- Creation of an array and store an element

```
; int[] A = new int[10];  
    bipush 10          ; put an integer represented as a byte onto the stack  
                        ; other relevant instructions:  
                        ; sipush <short integer>  
                        ; ldc <32-bit integer or float>  
  
    newarray int  
    astore_1  
  
    ; A[3] = 20  
    aload_1  
    iconst_3 ; iconst_<i> (i=-1, 0, 1, 2, 3, 4 or 5)  
    bipush 20  
    iastore
```

## Other Examples (cont.)

```
; l2 = A[3];  
aload_1  
iconst_3  
iaload  
istore_2
```

```
getstatic java/lang/System.out  
  Ljava/io/PrintStream;  
ldc "Hi! "  
iload_2  
invokestatic  
  io.print(Ljava/lang/String;I)V  
  
invokestatic io.println()V
```



```
bipush 10 ; size of the  
array  
iconst_3 ; element to  
change  
invokestatic  
  example1.f(II)I
```

```
; array[3];  
iconst_3 ; element  
iaload
```

```
invokestatic io.print(I)V ;  
print result
```