CSYE 6200

CONCEPTS OF OBJECT-ORIENTED DESIGN
FALL 2016 – WEEK 2

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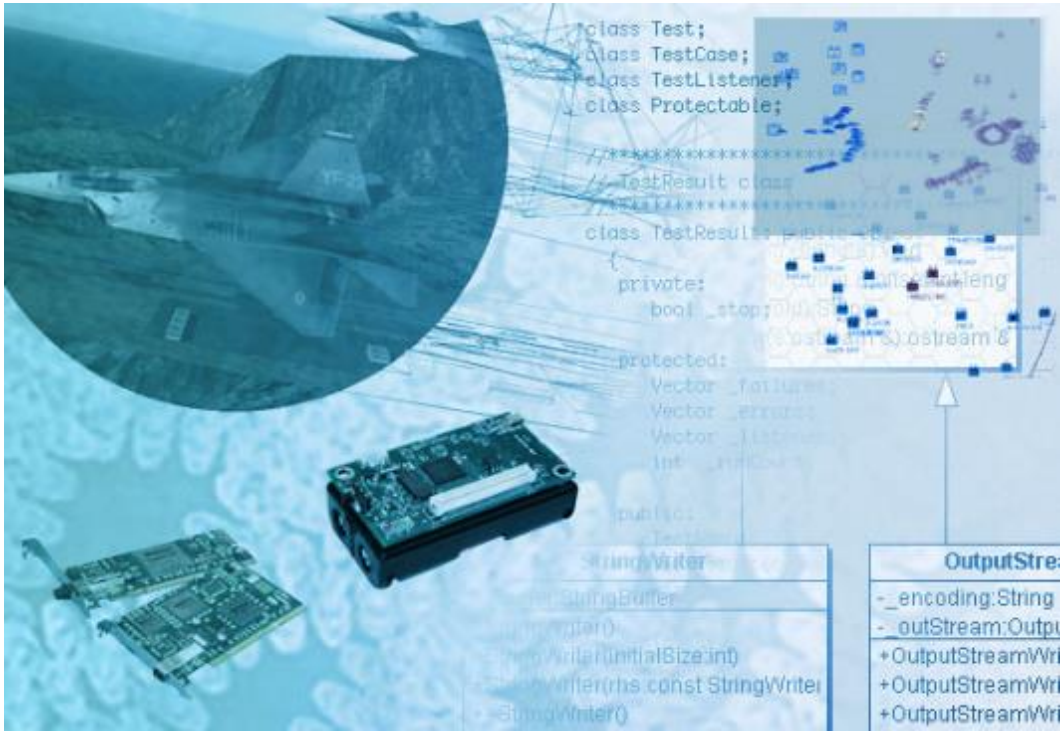


THE LECTURE

- Installing Java
- Recap
- Java Expressions and Operators
- Program Control
- Looping
- Assignment #1

JAVA EXPRESSIONS & OPERATORS

EXPRESSIONS

- Variables and literal values may be used in expressions
- Java supports standard operators for mathematics

Addition (+)	int x = 5 + 7;
Subtraction (-)	int y = x – 3;
Multiplication (*)	int z = x * y;
Division (/)	int a = z / 4;

ADDITIONAL OPERATORS

- **The remainder of an integer division may be computed using the modulo ("mod") operator**

  remainder = value % divisor

- **Examples:**
  - 15 % 3 = 0
  - 10 % 3 = 1
  - 12 % 15 = 12

ASSIGNMENT OPERATOR

The assignment operator has the form:

var* = *expression

Internally evaluated as var.operator=(*expression*)

Assignment may be chained:

```
int x, y, z;
x = y = z = 7;
```

Same as:

```
x = (y = (z = 7)))
```

OPERATOR PRECEDENCE

- **Each expression is evaluated using operator precedence**
  - ( ) Highest
  - * / %
  - + - Lowest
- **Operators with highest precedence are evaluated first, the lowest are evaluated last.**
- **Operators with equal precedence are evaluated from left-to-right.**
- **Example: x = 5 + (4 * 5) / 2**
  - x = 15

OPERATOR CONVENIENCE

Programs commonly have expressions like:

x = x + 1; or y = y / 8;

As a convenience, expressions of the form:

variable* = *variable* *oper value

may be expressed using a simplified notation:

variable* *oper= value

Expression	Convenience
x = x + 2	x += 2
x = x - 2	x -= 2
x = x * 2	x *= 2
x = x / 2	x /= 2

INCREMENT AND DECREMENT

It's also common in programs to increment and decrement variables:

```
variable = variable + 1; // increment by one
```

or

```
variable = variable - 1; // decrement by one
```

This happens so often, there is a special operator, so we can write the following instead:

```
variable++; // increment by one
```

and

```
variable--; // decrement by one
```

When the the C language was extended to add support for objects, the new language was called C++.

INCREMENT PREFIX/POSTFIX

- Increment/Decrement may be expressed in Prefix or Postfix form:

  `++val` or `--val` (Prefix form)

  `val++` or `val--` (Postfix form)

- All operators return a value that me be used in conditional evaluations

```
int cnt = 10;

if (cnt++ > 10) { }    resolves to if (11 > 10) { }
```

or

```
return(cnt++)
```

JAVA PRIMITIVE TYPES

Type	Meaning
boolean	Logical True/False values
byte	8-bit integer
char	Character
float	Single-precision floating point
double	Double-precision floating point
short	Half-precision integer
int	Integer
long	Double-precision integer

INTEGER NUMBERS

Type	Range	bits	Memory (bytes)
byte	-128 to 127	8	
short	-32,768 to 32,767	16	
int	-2,147,483,648 to 2,147,483,647	32	
long	+/- 9,223,372,036,854,775,807	64	

- **The default number type in Java is the int**
- **All Java values are signed [+/-] (C allows for unsigned values)**
- **Long values are typically used to hold the system clock time**

FLOATING POINT

Type	Form	bits	Memory (bytes)
float	IEEE 754 single precision	32	
double	IEEE 754 double precision	64	

- **Used for most floating point calculations**
- **Single precision float values are used to support older interfaces (like OpenGL graphics)**
- **Most math routines in Java use the double type, so this is the default choice**
- **Currency calculations should not use this type, but instead use the BigDecimal class**

CHARACTER

- **Characters in most other languages (like C) are encoded as 8-bit ASCII (American Standard Code for Information Interchange)**
  - Provided A-Z, 0-9, control characters, plus special and lower case characters
  - Could work on a 7 bit computer
- **Java switched to 16 bit UniCode characters**
  - Provided support for multiple language fonts
  - Supports bidirectional display
- **Example:**
  - `char c = 'g';`

BOOLEAN

- Represents a value of True or False
- Evaluates numerically as:

  True = 1

  False = 0

- Numbers may be considered to be a boolean value

```
if (x == 0) return false;
else return true; // anything but zero is true
```

RELATIONAL OPERATORS

Boolean operators evaluate a test condition to produce a true (1) or false (0) result

Comparators:

==	equals
!=	not equals
>	greater than
<	less than
>=	greater than or equal to
<=	less than or equal to

RELATIONAL OPERATORS

- **Relational operators return either a True (1) or a False (0)**
- **Relational operators may be used directly in expressions**

```
x = y * (y > 5);
// x is assigned the value of y if y is greater than five,
// otherwise, it is assigned as zero
```

- **Boolean values may be used directly in expressions**

```
boolean adjust = true;
x = y + (adjust) * 5;
```

LOGICAL OPERATORS

Logical operators evaluate two values to produce a result that can be evaluated as true or a false

&	**AND** ***(result of 0x000F & 0x1234 is 4)***
|	**OR** ***(result of 0x000F | 0x1234 is 0x123F)***
^	**XOR (exclusive OR)** **Used in non-destructive graphics**
!	**NOT**
&&	**Logical AND** ***(faster and always returns True or False)***
||	**Logical OR** ***(faster and always returns True or False)***

LITERALS

- **Primitive types may be assigned values from literals**
  - Default types are integers and doubles

```
int count = 5;
double wallLength = 23.3;
```

- **Float values may be specified using an 'F' or 'f' suffix**

```
float redVal = 0.45f;
```

- **Long values may be specified using an 'L" or 'l' suffix**

```
long timeDelta = 1045L;
```

- **Hex and Octal values**

```
int mask = 0x1A2F; // Hexidecimal(base 16)
int nine = 011; // 8 + 1 (base 8)
byte threeXfour = 0b1100; // 8 + 4 (base 2)
```

CASTING

- Primitive value types may be converted from one form to another through the use of casting "( )"
- Examples:

```
int count = 5; long timeCnt = 27L;
double dValue = (double) count;
int timeDelta = (int) timeCnt;
float greenVal = (float) dValue;
```

  Some rounding/clipping may result

- Casting may be combined with precedence

```
int minSize = (int) (xLen / yLen);
float greenVal = (float) (dVal * 2.34187);
```

INTEGER

PROGRAM CONTROL

PROGRAM CONTROL

- **Concepts**
  - Flow Control
    - `if`
    - `if-else`
    - `switch`
  - Looping
    - `for`
    - `while`
    - `do-while`
  - Loop exiting
    - `break`
    - `continue`

IF

- **The if Statement**
  - Allows code to selectively execute parts of a program

```
if (condition) statement;
or
if (condition) { statements }
```

- **Examples**

```
if (c < 10) System.out.println("c is less than ten");
if (c == 5) {
     System.out.println("c is equal to five");
     c = c+1;
     System.out.println("c plus one is : " + c);
}
```

IF-ELSE

- **The if-else Statement**
  - Allows code to selectively execute two paths of a program

```
if (condition) statement;
else statement;
```

or

```
if (condition) { statements }
else { statements }
```

- **Examples**

```
if (c < 10) System.out.println("c is less than ten");
else System.out.println("c is >= to ten");

if (c == 5) {
      System.out.println("c is equal to five");
      c++;
}
else {
     d = c * 2;
     c = c + 2;
     System.out.println("c is : " + c);
}
```

IF-ELSE CONT.

If statements may be nested

```
if (c > 5) {
     System.out.println("c is greater than five");
     if (cSize == 6) {
        System.out.println("cSize is equal to six");
     }
     c++;
}
```

If-else statements may be laddered

```
if (c == 1) System.out.println("Type 1");
else if (c == 2) System.out.println("Type 2");
else if (c == 3) System.out.println("Type 3");
else System.out.println("Type Unknown");
```

Laddering is so common, that a special flow control, called 'switch' was added to make it faster and simpler.

SWITCH

- `Switch` is a multi-way branch, that allows you to select from multiple alternatives

```
switch(expression) {
        case constant1:
                statement;
                break;
        case constant2:
                statement;
                break;
        default:
        case constant3:
                statement;
                break;
}
```

CONSTANTS

- Not all variables can vary. Some are constant.

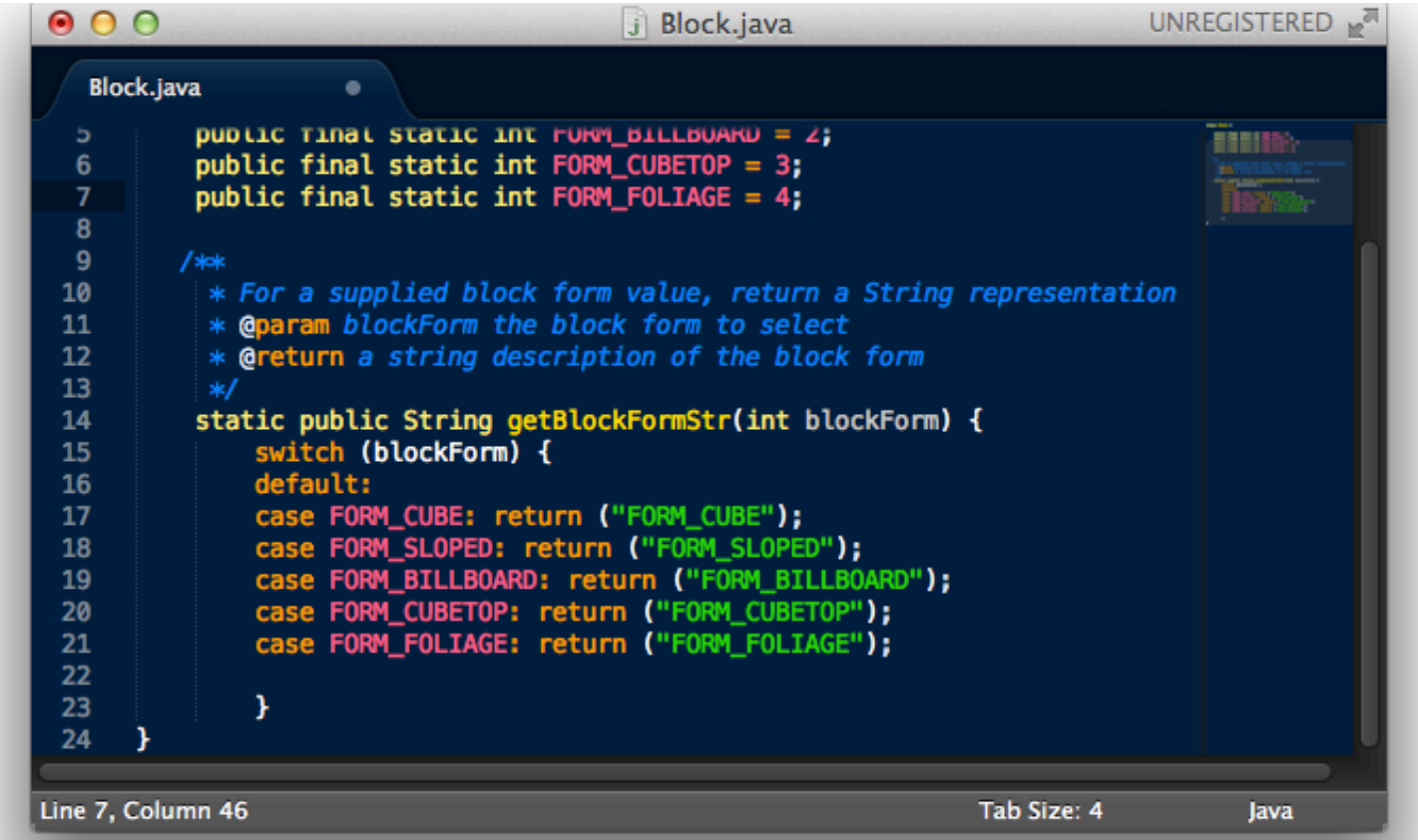
```
double area = 3.1415 * (r * r);

double weight = 9.8 * m;
```

- The inclusion of undocumented literal values is discouraged. A preferred approach is to use variables that are defined to be constant.

```
private static final double GRAVITY_ACCEL = 9.8;
```

- By convention, a constant value is named with UPPER_CASE_WITH_UNDERSCORES
- In the world of 'C', the `const` keyword is used instead of `final`.

SWITCH



LOOPING

FOR

- **The for Loop**
  - Repeatedly execute a sequence of code

```
for (initialization; condition; iteration) statement;
   or
for (initialization; condition; iteration ){statements}
```

  - Example

```
for (int count = 0; count < 10; count++) {
   System.out.println("This is count " + count);
}
```

WHILE

- **The while Loop**
  - Repeatedly execute a sequence of code

```
while (condition) statement;
or
while (condition){statements}
```

  - Example

```
int counter = 0;
boolean done = false;
while (!done) {
    System.out.println("This is loop pass " +
counter);
    counter++;
    if (counter == 10) done = true;
}
```

DO-WHILE

- **The do-while Loop**
  - Repeatedly execute a sequence of code

```
do {statements}
while (condition);
```

  - Evaluation occurs at the end, not at the beginning
  - {statements} are always executed at least once
  - Example

```
int counter = 0;
boolean done = false;
do {
   System.out.println("This is loop pass " + counter);
   counter++;
   if (counter == 10) done = true;
   }
while (!done);
```

BREAK

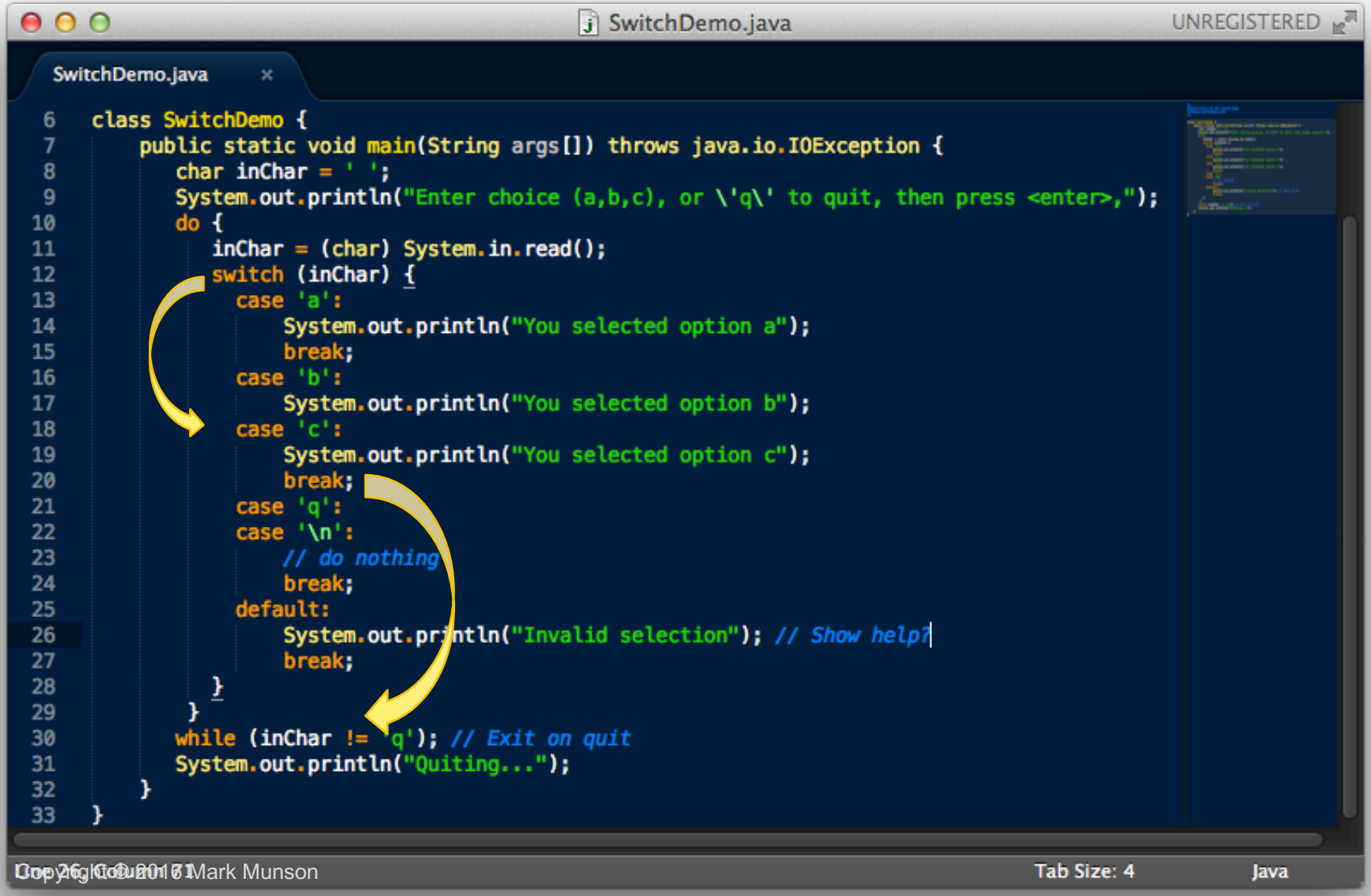
- Sometimes you want to exit a loop early. The `break` keyword forces an exit from the current loop, and can jump to a named block of code.

```
break label;
```

- Example:

```
for (int i = 0; i < 10; i++) {
   System.out.println("Counter i = " + i);
   int iSqr = i * i;
   if (iSqr == 9) break;
   System.out.println("iSqr = " + iSqr);
}
System.out.println("Done");
```

BREAK (CONT.)



CONTINUE

- To force an early completion of a loop pass, use the `continue` statement
- Example:

```
int sum = 0;
for (int i = 0; i <= 100; i++) {
   sum += i;
   if ((i%10) != 0) continue;
   System.out.println("i = " + i);
}
System.out.println("Done");
```