Data Conversion & Scanner Class

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ComS 207: Programming I (in Java)
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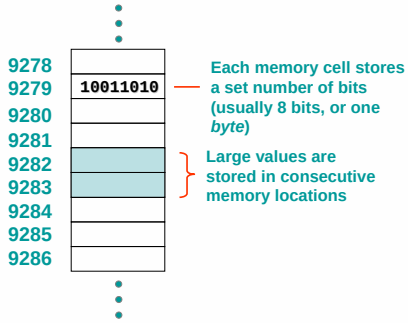
Quick review of last lecture

Numeric Primitive Data

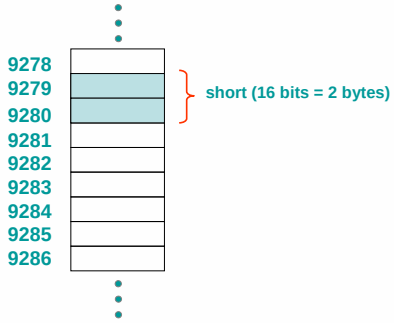
- **The difference between the various numeric primitive types is their size, and therefore the values they can store:**

Type	Storage	Min Value	Max Value
`byte`	8 bits	-128	127
`short`	16 bits	-32,768	32,767
`int`	32 bits	-2,147,483,648	2,147,483,647
`long`	64 bits	< -9 x 10^{18}	> 9 x 10^{18}
`float`	32 bits	+/- 3.4 x 10^{38} with 7 significant digits	
`double`	64 bits	+/- 1.7 x 10^{308} with 15 significant digits	

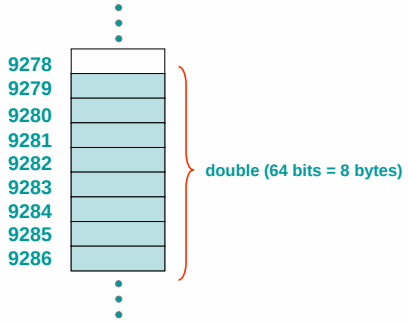
Storing Information



Storing a short



Storing a double



Operator Precedence

Precedence Level	Operator	Operation	Associates
1	+	unary plus	R to L
	–	unary minus	
2	*	multiplication	L to R
	/	division	
	%	remainder	
3	+	addition	L to R
	–	subtraction	
	+	string concatenation	
4	=	assignment	R to L

FIGURE 2.4 Precedence among some of the Java operators

Assignment Revisited

- The assignment operator has a lower precedence than the arithmetic operators

First the expression on the right hand side of the = operator is evaluated

```
answer  =  sum / 4 + MAX * lowest;
           4     1   3     2
```

Then the result is stored in the variable on the left hand side

Other material from Sec 2.4

Assignment Revisited

- The right and left hand sides of an assignment statement can contain the same variable

First, one is added to the original value of count

```
count  =  count + 1;
```

Then the result is stored back into count (overwriting the original value)

Increment and Decrement

- The increment and decrement operators use only one operand
- The *increment operator* (++) adds one to its operand
- The *decrement operator* (--) subtracts one from its operand
- The statement

```
count++;
```

is functionally equivalent to

```
count = count + 1;
```


Increment and Decrement

- The increment and decrement operators can be applied in *postfix form*:

```
count++
```

- or *prefix form*:

```
++count
```

- When used as part of a larger expression, the two forms can have different effects
- Because of their subtleties, the increment and decrement operators should be used with care

Assignment Operators

- Often we perform an operation on a variable, and then store the result back into that variable
- Java provides *assignment operators* to simplify that process
- For example, the statement

```
num += count;
```

is equivalent to

```
num = num + count;
```


Assignment Operators

- There are many assignment operators in Java, including the following:

Operator	Example	Equivalent To
+=	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

Assignment Operators

- The right hand side of an assignment operator can be a complex expression
- The entire right-hand expression is evaluated first, then the result is combined with the original variable
- Therefore

```
result /= (total-MIN) % num;
```

is equivalent to

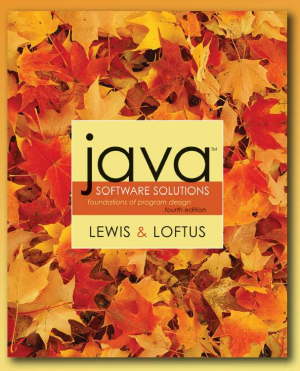
```
result = result / ((total-MIN) % num);
```


Assignment Operators

- The behavior of some assignment operators depends on the types of the operands
- If the operands to the += operator are strings, the assignment operator performs string concatenation
- The behavior of an assignment operator (+=) is always consistent with the behavior of the corresponding operator (+)

Chapter 2

Sections 2.5 & 2.6



2.5 Data Conversion

Widening Conversions

From	To
byte	short, int, long, float, or double
short	int, long, float, or double
char	int, long, float, or double
int	long, float, or double
long	float or double
float	double

FIGURE 2.5 Java widening conversions

Narrowing Conversions

From	To
byte	char
short	byte or char
char	byte or short
int	byte, short, or char
long	byte, short, char, or int
float	byte, short, char, int, or long
double	byte, short, char, int, long, or float

FIGURE 2.6 Java narrowing conversions

Conversion Techniques

- 1) Assignment conversion
  - Value of one type is assigned to a variable of another type during which the value is converted to the new type.
- 2) Promotion
  - Occurs automatically when certain operators need to modify their operands.
- 3) Casting (a.k.a. type casting)
  - Specified explicitly by the programmer

Assignment conversion

```
float money;
int dollars;

dollars=5;

money = dollars;  // OK, money is now equal to 5.0

dollars= money;   //Compile error
```


(automatic) promotion

```
float sum, result;
int count;

sum= 12.0;
count=5;

result = sum/count;  // count promoted to float
                     // before the division
```


(automatic) promotion

```
// the number '5' is first promoted to a string and then
// the two strings are concatenated

System.out.println("Five is equal to " + 5);
```

Type Casting

- The programmer explicitly asks the compiler to change the type of a variable or a temporary result before the next operation will take place.
- Without the cast Java typically will refuse to compile the program

Type Casting

```
float money;
int dollars;

dollars=5;

money = dollars;  // OK, money is now equal to 5.0

dollars= (int) money;   //Compile error OK
```


Type Casting + Promotion

```
float result;
int total, count;

total= 12;
count=5;

result =  (float) total / count;        //  result = 2.4
// 1. total is cast to float
// 2. count is promoted to float
// 3. the division is performed
```


Type Casting + Promotion

```
float result;
int total, count;

total= 12;
count=5;

result =  (float) (total / count);   //  result = 2.0
// 1. total and count a divided using integer division
// 2. the intermediary result is cast to a float
// 3. this float value is assigned to result
```


Casting Example

Interactive Programs

- Programs generally need input on which to operate
- The `Scanner` class provides convenient methods for reading input values of various types
- A `Scanner` object can be set up to read input from various sources, including the user typing values on the keyboard
- Keyboard input is represented by the `System.in` object

Reading Input

- The following line creates a Scanner object that reads from the keyboard:

```
Scanner scan = new Scanner (System.in);
```

- The new operator creates the `Scanner` object
- Once created, the `Scanner` object can be used to invoke various input methods, such as:

```
answer = scan.nextLine();
```

- In order to use the `Scanner` object you must put this line at the top of your Java program

```
import java.util.Scanner;
```


Reading Input

- The `Scanner` class is part of the `java.util` class library, and must be imported into a program to be used
- See Echo.java (page 91)
- The `nextLine` method reads all of the input until the end of the line is found
- The details of object creation and class libraries are discussed further in Chapter 3

Input Tokens

- Unless specified otherwise, *white space* is used to separate the elements (called *tokens*) of the input
- White space includes space characters, tabs, new line characters
- The `next` method of the `Scanner` class reads the next input token and returns it as a string
- Methods such as `nextInt` and `nextDouble` read data of particular types
- See GasMileage.java (page 92)

Scanner Class

```
Scanner (InputStream source)
Scanner (File source)
Scanner (String source)
        Constructors: sets up the new scanner to scan values from the specified source.

String next()
        Returns the next input token as a character string.

String nextLine()
        Returns all input remaining on the current line as a character string.

boolean nextBoolean()
byte nextByte()
double nextDouble()
float nextFloat()
int nextInt()
long nextLong()
short nextShort()
        Returns the next input token as the indicated type. Throws
        InputMismatchException if the next token is inconsistent with the type.

boolean hasNext()
        Returns true if the scanner has another token in its input.

Scanner useDelimiter (String pattern)
Scanner useDelimiter (Pattern pattern)
        Sets the scanner's delimiting pattern.

Pattern delimiter()
        Returns the pattern the scanner is currently using to match delimiters.

String findInLine (String pattern)
String findInLine (Pattern pattern)
        Attempts to find the next occurrence of the specified pattern, ignoring delimiters.
```

FIGURE 2.7 Some methods of the `Scanner` class

More Scanner Examples

THE END