CMSC 131
Object-Oriented Programming I

Wrappers, Stack, ArrayList, Switch

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This material is based on material provided by Ben Bederson, Bonnie Dorr, Fawzi Emad, David Mount, Jan Plane

Overview

- Wrappers
- Stack
- ArrayList
- Switch

Wrappers

- Java variables are either:

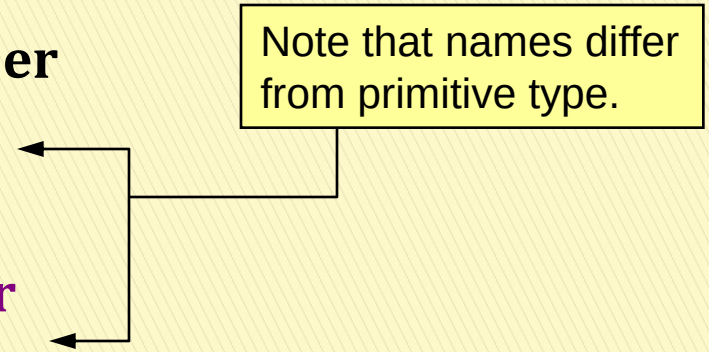
  Primitive types (int, float, double, …):
  - do **not** need to be created using "**new**"
  - do **not** support class **methods**

  Class Objects (String, Date, Rational, …):
  - must be created using "**new**"
  - support class **methods**
- Wouldn't it be nice if we could associate **methods** with **primitive types**? To do this, the Java library defines special classes, called **wrappers**, each of which contains a single primitive type as its instance data

Wrappers

- **Wrappers**: Each class "wraps" a class around a primitive type.

Primitive type	Wrapper
byte	Byte
short	Short
int	Integer
long	Long
double	Double
char	Character
boolean	Boolean



Wrapper Methods

- Each Wrapper provides a number of useful methods.
- **Integer Wrapper**: (other numeric wrappers are similar)

  Constructor: **Integer x = new Integer(324);**

  (no default constructor is provided)

  Max and min: **Integer.MAX_VALUE** largest positive int

  Integer.MIN_VALUE smallest negative int

  Conversions: **byte b = x.byteValue( );** cast x to byte

  double d = x.doubleValue( ); cast x to double

  int i = x.intValue( ); return integer value

  Convert string to int:

  int k = Integer.parseInt("123");

  Convert int to string in various bases:

  String s1 = Integer.toBinaryString(21); base 2

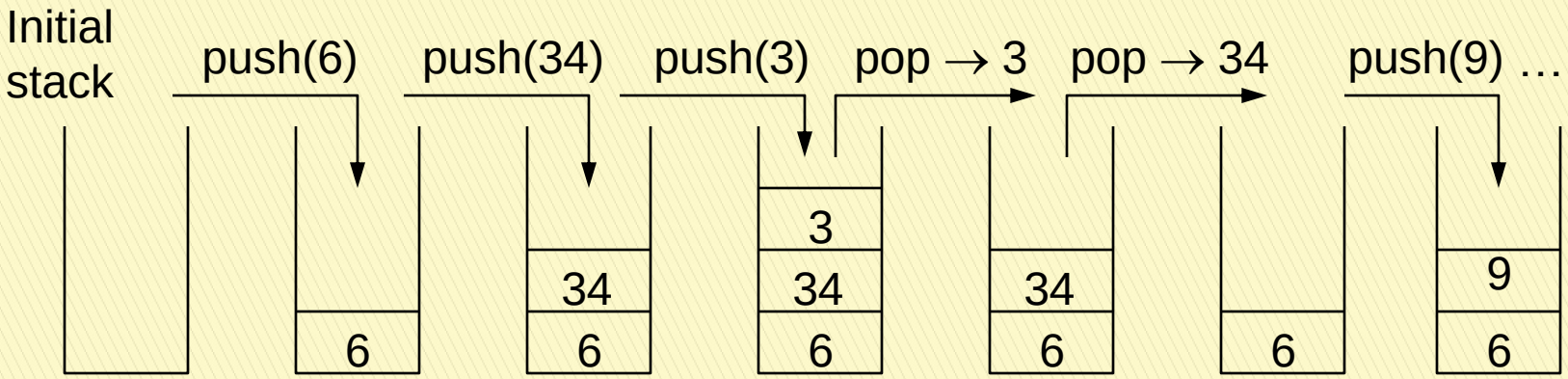
  String s2 = Integer.toHexString(21); base 16

  String s3 = Integer.toOctalString(21); base 8

- **Example:** WrapperExample.java

Stacks

- **Stack**: A stack is an **abstract data type** for storing a collection of items. Items can be **inserted** into the stack and **removed** from the stack, but the rule is the most recent item inserted is the first item to be removed. (**Last in, first out**)
- **Intuition**: Think of it like a stack of plates in a restaurant. Items:
  - can be inserted (or **pushed**) onto the top of the stack.
  - can be removed (or **popped**) off of the top of the stack.
  - insertions/removals from other positions are **not allowed**.



Stack Operations

- **Stack Operations**: An abstract (mathematical) stack supports:

  push(x): **inserts** item x at the top of the stack

  pop( ): **removes** the item at the top of the stack (if one exists) and returns its value

  top( ): **returns the value** of the item at the top of the stack, without removing it

  empty( ): **returns true** if the stack is **empty**

Java's Stack Class

- **Java's Stack class**: (in **java.util**) Java provides a Stack, with the following corresponding operations

  Stack( ): creates an empty stack

  push(Object x): pushes x on the stack

  pop( ): pops the stack and returns its value (Exception if empty)

  peek( ): returns (without removal) the top value of the stack (Exception if empty)

  empty( ): returns true if the Stack is empty.

ArrayList

- **The Problem with Arrays**:

  Resizing: Arrays are not suitable for situations where the size of the array changes frequently

  Appending to an Array: if we reach the maximum capacity of an array and we need to add an element, we have to create a new array, copy over elements, and add the desire element

- **ArrayList**:
  - A class in the Java class library that implements a **resizable array**.
  - It is part of the **java.util** package, and therefore an appropriate **import** statement is required
  - An ArrayList holds references to objects. We need to specify the kind of object the ArrayList will store. If we are storing any **primitive type** then we need to use the appropriate **wrapper** (e.g., Integer)

ArrayList Methods

- **ArrayList Default Constructor** Initializes an array list of size 0
- **add** → adds object to the end of the array. (Automatically expands the array if needed.)
- **remove(int i)**: Removes the element at index i. (Shifts the remaining elements to close the gap.)
- **get(int i)**: Returns a reference to the element at index i
- **toArray()**: Returns a (standard) array with all the elements.
- **clear()**: removes all the elements from ArrayList
- **size()**: returns the number of elements in ArrayList
- Java API Entry
  - http://download.oracle.com/javase/6/docs/api/index.html
- **Example:** ArrayListExample.java

The Switch Statement

- **Switch Statement:** is a convenient (and often more efficient) way to perform a **multi-way conditional** based on a single control value.
- **Example**:

```
switch ( option ) {
case 1:
   System.out.println( "Read image" );
   break;
case 2:
   System.out.println( "Double" );
   break;
case 9:
   System.out.println( "Quit" );
   break;
default:
   System.out.println( "Sorry, invalid" );
   break;
}
```

The "default" case is chosen if none of the cases match

Original:

```
if ( option == 1 )
   System.out.println( "Read image" );
else if (option == 2 )
   System.out.println( "Double" );
else if ( option == 9 )
   System.out.println( "Quit" );
else
   System.out.println( "Sorry, invalid" );
```

The case that is chosen depends on the value of "option"

The Switch Statement

- General form:

```
switch ( ⟨control-expression⟩ ) {
case ⟨case-label-1⟩ :
   ⟨statement-sequence-1⟩
   break;
case ⟨case-label-2⟩ :
   ⟨statement-sequence-2⟩
   break;
...
case ⟨case-label-n⟩ :
   ⟨statement-sequence-n⟩
   break;
default :
   ⟨default-statement-sequence⟩
   break;
}
```

The control-expression is one of the following types: char, int, short, byte

Each case label must be of a type that is compatible with the control expression.

You may have any number of statements, including nesting of if-else and loops.

The "break" statement jumps out of the switch statement.

The "default" case is optional, and is executed if none of the other cases match.

The Switch Statement

- The **control expression** can be of one of the following types:
  char, int, short, byte.
  - **not** float or double,
  - **not** boolean or long
  - **not** an object (Too bad! Strings would have been nice.)
- The "**break**" statement jumps out of the switch statement. Otherwise control flow just "**falls through**" into the next case.

This is not correct!

```
int option = 2;
switch ( option ) {
case 1:
   System.out.println( "Read image" );
case 2:
   System.out.println( "Double" );
case 9:
   System.out.println( "Quit" );
default:
   System.out.println( "Sorry, invalid" );
}
```

Output:

```
Double
Quit
Sorry, invalid
```

This is probably not what you intended.

The Switch Statement

- The **falling though** behavior is handy, because it allows you to combine cases.
- **Example**: Allowing either upper-case or lower-case for characters:

```
char command = 'D';
switch ( command ) {
   case 'i':
   case 'I':
      MyUtility.insert( );
      numberOfItems++;
      break;
   case 'd':
   case 'D':
      MyUtility.delete( );
      numberOfItems--;
      break;
   ...
}
```

Note: This is a char, not a String.

This is performed for either ‘I’ or ‘i’