Announcements for This Lecture

Readings

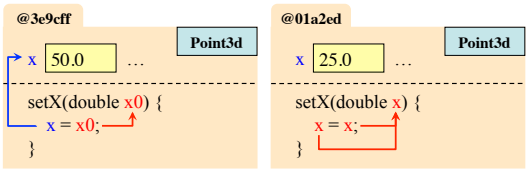
- pp. 175–181
- Sections 2.5, 3.1.2-3.1.3
- (optional) PLive p. 2-5

Assignments

- Assignment 1 due tonight
  - Before Midnight!!!
  - Will have get by class Thu
  - Revise if you are told
- New Assignment Posted
  - No code; written only
  - Meant to do while you revise
  - Due in class next week
- Will go to 2-week assignment schedule after Assignment 3

Inside-Out Rule (See p. 83)

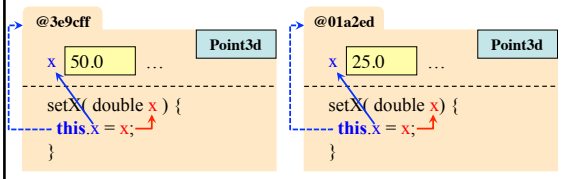
- Parameter x0 is found in the frame for the method call. Exists temporarily
- Parameter x "blocks" (or **shadows**) the reference to the field x.



A Solution: `this`

`this` is a built-in "variable" that gives an object name

- In object (folder) **@3e9cff**, **this** refers to **@3e9cff**
- In object (folder) **@01a2ed**, **this** refers to **@01a2ed**

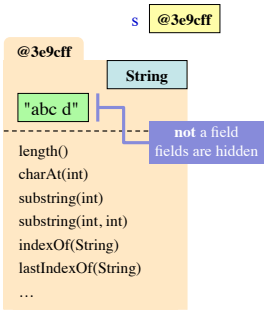


String is a Class; Quoted Text is an Object

- String s = "abc d";
- Indexed characters:

```
01234
abc d
```

- s.length() is 5
- s.charAt(2) is 'c'
- s.substring(2) is "c d"
- s.substring(1,3) is "bc"



String Has a Lot of Useful Methods

- String s = "abc d";
- Indexed characters:

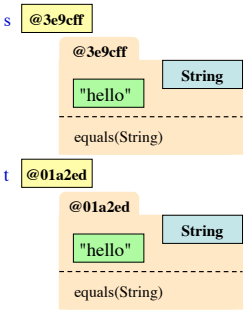
```
01234
abc d
```

- See text pp. 175–181
- Look in CD ProgramLive
- Look at API specs for String

- s.substring(2,4) is "c " **(NOT "c d")**
- s.substring(2) is "c d"
- " bcd ".trim() is "bcd"
  (trim beginning and ending blanks)
- s.indexOf("bc") is 1
  (index or position of first occurrence of in "bc" or -1 if none)

String Variables Hold Folder Names

- Create two Strings
  - String s = "hello";
  - String t = "hello";
- Do not use == to test equality of s and t
  - s == t tests if same object
  - Not useful for Strings
- Use equals() instead
  - s.equals(t) tests if they have the same text



Algorithms: Heart of Computer Science

- **Algorithm**: A step-by-step procedure for how to do something (usually a calculation).
- **Implementation**: How to write an algorithm in a specific programming language
- Good programmers know how to separate the two
  - Work out algorithm on paper or in head
  - Once done, implement it in the language
  - Limits errors to syntax errors (easy to find), not conceptual errors (much, much harder to find)
- Key to designing algorithms: **stepwise refinement**

Stepwise Refinement: Basic Principles

- **Write Specifications First**
  Write a method specification before writing its body
- **Take Small Steps**
  Do a little at a time; follow the **Mañana Principle**
- **Compile Often**
  This can catch syntax errors
- **Separate Concerns**
  Focus on one step at a time
- **Intersperse Programming and Testing**
  When you finish a step, test it immediately

Mañana Principle

- If not in current step, delay to "tomorrow"
  - Use comments to write steps in English
  - Add "stubs" to ensure the program compiles (e.g. empty definitions or bogus return statements)
  - Slowly replace stubs/comments with real code
- Only create new local variables if you have to
- Sometimes results in creation of more methods
  - Replace the step with a method call
  - But leave the *method definition* empty for now
  - This is called **top-down design**

Example: Reordering a String

- lastNameFirst("Walker White") is "White, Walker"

```
/** Yields: copy of s but in the form <last-name>, <first-name>
 * Precondition: s is in the form <first-name> <last-name>
 *               with one blank between the two names */
public static String lastNameFirst(String s) {
    // Find the first name
    // Find the last name
    // Put them together with a comma
    return ""; // Stub return
}
```


Example: Reordering a String

- lastNameFirst("Walker White") is "White, Walker"

```
/** Yields: copy of s but in the form <last-name>, <first-name>
 * Precondition: s is in the form <first-name> <last-name>
 *               with one blank between the two names */
public static String lastNameFirst(String s) {
    int endOfFirst = s.indexOf(" ");
    String firstName = s.substring(0,endOfFirst);
    // Find the last name
    // Put them together with a comma
    return firstName; // Stub return (which you can test!)
}
```


Refinement: Creating Helper Methods

Do This Sparingly

- If you might use this step in **another** method later
- If implementation is rather long and complicated

```
public static String
  lastNameFirst(String s) {
    String firstName = firstName(s);
    // Find the last name
    // Put together with comma
    return firstName; // Stub
}
```

```
/**
 * Yields: first name in s
 * Precondition: s is in the form
 * <first-name> <last-name>
 * with one blank between names
 */
public static String
  firstName(String s) {
    int end = s.indexOf(" ")
    return s.substring(0,end);
}
```