CompSci 4
Java 1
Nov 18, 2008

Prof. Susan Rodger
Announcements

• Assignment 7 questions?
  – Beware having two events that kick in at the same time!
  – Beware of infinite loops!

• What we will do today
  – Compare Alice and Java
  – Learn a little Java
  – Experiment with Java
Chap. 11 – What’s Next? Java

- Java – object-oriented programming language
  - Classes, objects, inheritance
  - Control structures (if, while)
  - Functions, methods
  - Data types (integers, doubles, strings, arrays, lists)

- Sound familiar?
Turn Alice code into Java Code

- Select Edit Preferences

- Must restart Alice
Some Data Types in Java

• integer
  – Declare and initialize
    ```java
    int value = 0;  // variable is value
    ```
  – Update/modify
    ```java
    value = value + 2;
    ```

• Real numbers
  ```java
  double number = 4.5;
  number = number * 2.0; // multiply by 2
  ```

• Careful with integer operations
  ```java
  value = 6/4;  // what is value?
  ```
String data type in Java

- String is a class
- Declare String variable and initialize
  ```java
  String phrase = "";
  phrase = "CompSci 4";
  ```
- Convert String to array of characters
  ```java
  phrase.toCharArray()
  ```

- | C | o | m | p | S | c | i | 4 |
  - | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
char type in Java

- char is for one character
- Note char uses single quotes, string uses double quotes

```java
char ch = 'a';
if (ch == 'a')
{
    return "found match";
}
else
{
    return "no match";
}
```
Some String member functions

- String is a class, so has member functions
  
  ```java
  String phrase = "CompSci 4";
  ```

- `length()` - returns number of characters in String

  ```java
  int size = phrase.length();
  ```

- `toCharArray()` - converts string to array of characters and returns the array

- `charAt(int position)` - returns the character in an array at position

  ```java
  char ch = phrase.charAt(2);
  ```
Looping over a String

- Collections loop – converts the String letters to a character array and iterates over the array with ch being one character from the array each time.
- Like Alice, getting one item-from-list at a time

```java
for (char ch: letters.toCharArray())
{
    // do something here with ch
}
```

Must have Java 1.5 for collections loop!
Looping over a String – Java 1.4 or less

- Can’t use Collections loop
- Use for loop instead – like complicated loop in Alice
- Like Alice, getting one item-from-list at a time
- Assume string variable is called \texttt{words}

```java
for (int item=0; item< \texttt{words}.length(); item = item+1)
{
    // do something here with \texttt{words.charAt(item)}
    // that is one character from \texttt{words} at a time
}
```
Conditionals – Format of “if”

- Must have ( )’s around condition!
- Can leave “else” part off

```cpp
if ( condition) {
    // do if condition is true
} else   // can leave off if no else part
    {
    // do if condition is false
}
```
Relational/Logic Operators

- Relational operators
  
  `\(<\)` `\(\rangle\)` `\(\leq\)` `\(\geq\)` `\(==\)` `\(!=\)`

- Logic Operators
  
  - `\(\&\&\)` (and)
  - `\(||\)` (or)
  - `\(!\)` (not)

```java
if ((x > 0) && (y != 3))
{
    // do something
}
```
Problem 1 to Solve in Java

• Bioinformatics
  – Area of computer science
  – Application of computational techniques to the management and analysis of biological information

• Problem: Given a strand of DNA, determine the number of cytosine nucleotides present
Problem: Rewritten for CompSci

- DNA is a string – array of characters
  - Only has letters c, t, a and g
- Problem restated: how many c’s in a string?
- Example: “catacgtagtc”
  - Answer: 3 c’s
- Write a method to return this number
  - See sheet for problem DNA-1
What does code mean?

- Name of class
- Name of method in class
- Return value (int is integer or number)
- One parameter (type and name)

```java
public class DNAProfile {
    public int count(String dna) {
        // fill in code here
    }
}
```
public class DNAprofile{
    public int count(String dna) {
        // fill in code here
    }
}
How We Will Solve Problems in Java

- Write methods and test with testing interface: APT
  - Not a whole Java program, just a small part
- Write a complete Java program
  - Not yet

- Use a programming environment Eclipse to make it easier
- Use submission tool Ambient
- See CompSci 4 resources page to install!
Solve this Problem

• Write a method and test it on the APT

  – Type our solution into Eclipse

  – Load the file into APT (web page) and submit
Create a New Project in Eclipse

- Start Eclipse
- Select File -> New -> Project
  - Select Java Project and Next
  - Enter Project Name CPS4Sec1DNA (or Sec2)
Create a Class and Method

• Click on project CPS4Sec1DNA
  – Select File -> New -> Class
  – Enter name DNAprofile
  – Select Finish
  – DNAprofile window appears
  – Cut and paste the method “count” from the web page to the class
  – Complete the method

• Put all classes you create today in the same project!
Testing a method using APT

CompSci 4, Fall 2008, APT

- Use APT to test method
- Select problem, load file, test/run.
- Class laptops – file is in C: workspace

If you use this page again you may have to reload/rebrowse for the program and reselect the problem.

<table>
<thead>
<tr>
<th>Problems</th>
<th>Choose One to Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DNA-1, Count C's</td>
<td>○ DNA-1, Count C's</td>
</tr>
</tbody>
</table>

For Lecture Nov 18 (Prof. Rodger to demo)

Test file: [Input Field] [Browse] [Test/Run]

<table>
<thead>
<tr>
<th>Problems</th>
<th>Choose One to Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. DNA[ecdiff], How Many More C’s than G’s</td>
<td>○ DNA[ecdiff], How Many More C’s than G’s</td>
</tr>
<tr>
<td>3. DNA-2, CG Ratio</td>
<td>○ DNA-2, CG Ratio</td>
</tr>
</tbody>
</table>

For Classwork Nov 18

Test file: [Input Field] [Browse] [Test/Run]
Want Green, not red!

- Execution of the apt

<table>
<thead>
<tr>
<th>Problem: dna1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language: java</td>
</tr>
<tr>
<td>Files:</td>
</tr>
<tr>
<td>• DNAprofile.java... DNAprofile ... java ... 20 line(s).</td>
</tr>
</tbody>
</table>

javac DNAprofile.java

Compilation successful.

**Program running:** standard output below

---

Test Results Follow (scroll to see all)

<table>
<thead>
<tr>
<th># of correct: 3 out of 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 fail</td>
</tr>
<tr>
<td>2 pass</td>
</tr>
<tr>
<td>3 fail</td>
</tr>
<tr>
<td>4 fail</td>
</tr>
<tr>
<td>5 fail</td>
</tr>
<tr>
<td>6 fail</td>
</tr>
<tr>
<td>7 pass</td>
</tr>
</tbody>
</table>
**Debugging your program**

- Scroll down to see more detail
- Shows expected value, calculated value, and input value

<table>
<thead>
<tr>
<th></th>
<th>expected</th>
<th>got</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>fail</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;cgaatgcgcgcgcg&quot;</td>
</tr>
<tr>
<td>2</td>
<td>pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;cccccccccccccccc&quot;</td>
</tr>
<tr>
<td>3</td>
<td>fail</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;g&quot;</td>
</tr>
</tbody>
</table>
Saving your work to your Duke Account – if on class laptop

- Check in your project by selecting “Ambient”, “Check in project”
- First time only (Window -> preferences -> ambient -> checkin/checkout -> setup CVS)
- Enter your Duke account password
- If partner wants to save after one has saved, must click on project, select “Team”, then “disconnect”, then partner can try to save
Classwork today

• Solve the three APTs on the CompSci 4 APT web page (create one Java project with three classes)
  – DNA-1 CGTA counting
  – DNAcgdiff
  – DNA-2 CG counting

• Get work checked off – show runs and code

• Save files on Duke account
  – Ambient check in
    – FIRST TIME only (window -> preferences -> ambient -> checkin/checkout - setup CVS repository)