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()
  ```

Some String member functions

- String is a class, so has member functions
  ```java
  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);
  ```

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
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

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 words
for (int item=0; item< words.length(); item = item+1)
{
    // do something here with words.charAt(item)
    // that is one character from words at a time
}

Conditionals – Format of “if”

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

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
  <  >  <=  >=  ==  !=
• Logic Operators
  – && (and)
  – || (or)
  – ! (not)

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: “catacgtatagtc”
  - 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
    }
}
```

Solve Problem on Paper
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

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

Want Green, not red!

• Execution of the apt

**Problem: deal**
**Language:** java
**Files:**
- DNAprofile.java, DNAprofile ... java ...
- Java3 DNAprofile.java

Compilation successful.
Program running: standard output below

---

Test Results follow (scroll to see all)

<table>
<thead>
<tr>
<th>Test</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>fail</td>
</tr>
<tr>
<td>2</td>
<td>pass</td>
</tr>
<tr>
<td>3</td>
<td>fail</td>
</tr>
<tr>
<td>4</td>
<td>fail</td>
</tr>
<tr>
<td>5</td>
<td>fail</td>
</tr>
<tr>
<td>6</td>
<td>fail</td>
</tr>
<tr>
<td>7</td>
<td>pass</td>
</tr>
</tbody>
</table>

---

Debugging your program

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

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