CompSci 4
Java 1
Apr 2, 2009

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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

![Preferences dialog box]

• 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()
  ```

- `CompSci 4`
char type in Java

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

    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
  String phrase = “CompSci 4”;
- length() - returns number of characters in String
  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
  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 each 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!
Example – what does this do?

```java
int sum = 0;
String phrase = "3 weeks left";
for (char ch: phrase.toCharArray())
{
    sum = sum + 1;
}
```
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

```c
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)

```java
if ((x > 0) && (y != 3)) {
    // do something
}
```
Example – what does this do?

```java
String letters = "CompSci 4 rocks";
int sum = 0;
for (char ch: letters.toCharArray())
{
    if (ch == 'S' || ch == 's')
    {
        sum = sum + 1;
    }
}
```
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
    }
}
```
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 test/run

CompSci 4, Spring 2009, APT

• Choose the problem you want to submit/test --- you should look at the problem statement, think about how to solve it, then write code to solve it. Next test your code via the online testing mechanism.
• Click Browse... to choose the file on your local system you'll test online.
• Click test/run to test the program.

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>
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</tr>
<tr>
<td>2. DNAacgdiff, How Many More C's than G's</td>
<td>DNAacgdiff, How Many More C's than G's</td>
</tr>
<tr>
<td>3. DNA-2, CG Ratio</td>
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</table>

Test file: E:\workspace\spring08\CPS4Nov18Sec2\src\DNAprofile.java
Create a New Project in Eclipse

• Start Eclipse

• Select File -> New -> Project
  – Select Java Project and Next
  – Enter Project Name CPS4Sec1DNA
  – Think of project as an Alice world with lots of classes
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

Compsci 4, Spring 2009, APT

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Test file: E:\cps3\workspace\spring08\CPSC4Nov18Sec2\src\DNAprofile.java
Want Green, not red!

- Execution of the apt

**Problem:** dna1
**Language:** java

**Files:**
- DNAprofile.java... DNAProfile... java... 20 line(s).

javac DNAprofile.java

Compilation successful.

**Program running:** standard output below

---

Test Results Follow (scroll to see all)

# of correct: 3 out of 12

<p>| | |</p>
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<tr>
<td>1</td>
<td>fail</td>
</tr>
<tr>
<td>2</td>
<td>pass</td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
<td>fail</td>
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<td>5</td>
<td>fail</td>
</tr>
<tr>
<td>6</td>
<td>fail</td>
</tr>
<tr>
<td>7</td>
<td>pass</td>
</tr>
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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
• If on class laptop, save files on Duke account
  – Ambient check in
    – **FIRST TIME only** (window -> preferences -> ambient -> checkin/checkout - setup CVS repository)