Computing Basics

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Computational Physics for Undergraduates
BS Degree Program: Oregon State University

“Engaging People in Cyber Infrastructure”
Support by EPICS/NSF & OSU
Computers Do Exactly as Told

- Tell them exactly, everything
- Programs: explains all
- Understand: in control
- Computers: basic machine language
- Scientists: high level

Problem solving environment

- Shell = command-line interpreter
- Operating systems
- GUI, Kernel
Types of High-Level Languages

- Problem Solving Environments
  - far from hard/software, algorithms

- Compiled (Fortran, C)
  - translates entire program to basic ML
  - all at one time, fast
  - Translates via rules & dictionary
  - ⇒ object code (not for humans)

- Interpreted language (BASIC, Maple)
  - Translate 1 statement at a time
  - more immediate response, friendly, slow

- Java: mixed bag, universal, portable
Programming Concepts (programming assumed)

**Pseudocode**

<table>
<thead>
<tr>
<th>code</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>calculate area of circle</td>
<td>// Do this, computer!</td>
</tr>
</tbody>
</table>

**Not specific enough**

<table>
<thead>
<tr>
<th>code</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>read radius</td>
<td>// Input</td>
</tr>
<tr>
<td>calculate area of circle</td>
<td>// Numeric</td>
</tr>
<tr>
<td>sprint area</td>
<td>// Output</td>
</tr>
</tbody>
</table>

**Specifies algorithm**

<table>
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<tr>
<td>read radius</td>
<td>// Input</td>
</tr>
<tr>
<td>// calculate area of circle</td>
<td>// Comment</td>
</tr>
<tr>
<td>pi = 3.141593</td>
<td>// Set constant</td>
</tr>
<tr>
<td>area = pi * radius^2</td>
<td>// Algorithm</td>
</tr>
<tr>
<td>print area</td>
<td>// Output</td>
</tr>
</tbody>
</table>
public class CircleArea {
    public static void main(String[] args) {
        double radius, circum, area, PI;
        radius = 1.;
        PI = Math.PI;
        circum = 2.* PI * radius;
        area = radius * radius * PI;
        System.out.println("Circum = " + circum + " Area = " + area);
    }
}

Java Implementation

public class CircleArea {
    // Begin class
    {
        public static void main(String[] args) // Begin main
        {
            double radius, circum, area, PI; // Set precision
            radius = 1.; // Assign radius
            PI = Math.PI;
            circum = 2.* PI * radius; // Calc circum
            area = radius * radius * PI; // Calc area
            System.out.println("Circum = " + circum + " Area = " + area);
        } // End main
    } // End class

Introductory Computational Science

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Time for Exercises in Lab
Welcome to our first Computer Lab session

- We discuss a few interesting exercises
- See class page for specific assignment
- Details, more exercises in text
- You work on own or with local instructor
- Meant to be “lab”, i.e. experiments on computer
- No one “correct” answer
Exercise: Shells, Editors, Programs

1. Create folder/directory “CSE”
   a. create subdirectories for each week

2. Enter (editor) area.c, areas.f or Area.java
   a. Save file

3. Compile and execute Area

4. Check program;  \( r=1., \ r=10. \)

5. Experiment:  \( r = 1, \ r = , \ r = a \)

6. Use scanner (j2se/1.5.0): keyboard input

7. Output to file

8. Revise: main for I/O, method for calculation