Building Larger Programs: Our Toolkit

• Graphics
  – lines, shapes, images, text, color, ...

• Data of Various Types
  – numbers (integers and real values)
  – booleans (true, false)
  – characters and Strings

• Variables
  – hold/name any type of data values

• Arrays

• Operators
  – Mathematical (+, *, ++, %, …)
  – Relational (<, >=, !=, ==, …)
  – Logical (&&, ||, !)
Building Larger Programs: Our Toolkit (Continued)

• Functions
  – Mathematical, Graphical, Utility, ...
  – Of our own design

• Expressions
  – Combine of data, variables, operators, functions

• Conditionals
  – if-statements
  – switch-statement

• Iterations
  – while-loop
  – for-loop

• Data Structures
  – Arrays
  – Functions that manipulate arrays

• Objects
Top-Down Design

• At first, solving a hard problem can seem daunting
  – Create a clone of Adobe Photoshop
  – Create a new web browser

• A common technique for solving complex problems is called **Top-Down Design**
  – a.k.a. "Step-wise Refinement"
    1. Define a sequence of steps to solve a given problem at the highest, most abstract level
    2. Recursively, list a sequence of sub-steps to solve each higher-level step
    3. Repeat until the sub-problem is "easy enough" to solve directly
Top-Down Design - Advantages

• Promotes Organization
  – Your code is naturally organized, and easy to understand
  – Avoids the "spaghetti code" syndrome

• Simplifies the Problem
  – The larger complex problem reduces to several smaller, more simple problems

• Promotes Reuse
  – Several sub-problem solutions may be reusable by multiple parts of your program
  – Some sub-problems have existing solutions implemented

• Enables Shared Development
  – Multiple people can work on different parts of the problem at the same time
Top-Down Design - Example

Have Dinner
1. Cook Food
2. Set Table
3. Serve Food
4. Eat Food
5. Clean Up
Top-Down Design - Example

Have Dinner

1. Cook Food
   1. Boil Noodles
   2. Stir-fry Veggies
   3. Mix together

2. Set Table

3. Serve Food

4. Eat Food

5. Clean Up
Top-Down Design - Example

Have Dinner

1. Cook Food
   1. Boil Noodles
      1. Boil water
      2. Pour in dry noodles
      3. Let cook
      4. Strain noodles
   2. Stir-fry Veggies
   3. Mix

2. Set Table

3. Serve Food

4. Eat Food

5. Clean Up