CMSC 104 - Lecture 19 Park , adapted by C Grasso

Algorithms: Part 2

# Algorithms, Part 3 of 3

#### <u>Topics</u>

- Algorithms: Brief Review
- In-Class Project: Tip Calculator
- In-Class Project: Drawing a Rectangle

## Definition of an Algorithm [Review]

- Our final definition:
  - An algorithm is a finite set of unambiguous, executable instructions that directs a terminating activity.

#### A Generic Algorithm [Review]

What is a generic algorithm for a given problem?

An algorithm for solving the problem, that has been generalized to work with **a variety of possible input parameters** to produce inputspecific solutions.

#### Pseudocode: Control Structures

Any problem can be solved using only three logical **control structures**:

- Sequence
- Selection
- Repetition



- A series of steps or statements that are executed in the order they are written.
- Example:

Display "Enter two numbers: " Read <number1> Read <number2> <sum> = <number1> + <number2> Display "sum = ", <sum>

## Selection

- Defines one or more courses of action depending on the evaluation of a condition.
- Synonyms: conditional, branching, decision
- Examples:
  - If (condition is true) do this End\_if E

If (condition is true) do this Else do that End\_if

## Repetition

- Allows one or more statements to be repeated as long as a given condition is true.
- Synonyms: looping, iteration
- Example:
  - While (condition is true)
    - do this
  - End\_while

#### Pseudocode Style

- Any user prompts should appear exactly as you wish the programmer to code them.
- The destination of any output data should be stated, such as in "Display", which implies the screen.
- Make the data items clear (e.g., surround them by < and</li>
  ) and give them descriptive names.
- Use formulas wherever possible for clarity and brevity.
- Use keywords (such as Read and While) and use them consistently. Accent them in some manner.

#### Pseudocode (con't) [Review]

- Use indentation for clarity of logic.
- Avoid using code. Pseudocode should not be programming language-specific.
- Always keep in mind that you may not be the person translating your pseudocode into programming language code. It must, therefore, be unambiguous.
- You may make up your own pseudocode guidelines, but you MUST be consistent.

#### Pseudocode Example

Display "Enter the number of children: " Read <number of children> Display "Enter the number of cookies remaining: " Read <cookies remaining> <original cookies> = <cookies remaining> While (<number of children> > 0)

<original cookies> = <original cookies> X 2

<number of children> = <number of children> - 1

End\_While

Display "Original number of cookies = ", <original cookies>

#### Writing Algorithms from Scratch

- Given a problem statement, we are going to write the corresponding generic algorithm for the solution.
- We will use the following procedure:
  - Determine the algorithm inputs and outputs
  - Complete the pseudocode

## **Simple Tip Calculator**

<u>Problem</u>: Write an interactive program to calculate the dollar amount of the tip on a restaurant bill at the standard 20% rate. You should allow for changes in the total price of the bill.

#### **Drawing a Rectangle**

<u>Problem</u>: Write an interactive program that will draw a solid rectangle of asterisks (\*) of userspecified dimensions. The program must also display the dimensions of the rectangle. Error checking must be done to be sure that the dimensions are greater than zero.

## **General Tip Calculator**

Problem: Write an interactive program to calculate a table of dollar amounts of tip on a restaurant bill. You should allow for changes in the total price of the bill. You should also ask the user for the range of tipping rates to calculate (i.e., low and high ends). Error checking should be done to be sure that the amount of the bill is greater than o.

#### **Group Exercise**

- Drawing a Rectangle: Write an interactive program that will draw a solid rectangle of asterisks (\*) of user-specified dimensions. The program must also display the dimensions of the rectangle. Error checking must be done to be sure that the dimensions are greater than zero
- Tip Calculator:

Write an interactive program to calculate a table of dollar amounts of tip on a restaurant bill. You should allow for changes in the total price of the bill. You should also ask the user for the range of tipping rates to calculate (i.e., low and high ends). Error checking should be done to be sure that the amount of the bill is greater than o.