



Algorithms

Computer Science Principles

Problem Solving Tools

- Programs are created to solve problems.
- A solution must be designed prior to coding.
- One method of designing a solution to a problem is to create an *algorithm*.

Algorithms

- An **algorithm** is a list of steps to solve a problem written in plain English.
 - **Steps** to solve a problem are written out and numbered in the order in which they should be executed.
- They should be as extensive as necessary to outline the solution.
- Your algorithm is not only going to tell your program what to do but how to do it.

Algorithm Example – Going Home

- The Walk Algorithm

1. Leave classroom
2. Turn right out of school building
3. Walk 1.2 miles
4. Turn right on street
5. Go to 4th house

- The Bus Algorithm

1. Go to the bus area
2. Get in right bus
3. Go to house

Algorithms

- Both algorithms, and others that accomplish the same task (of getting you home).
- There are advantages and disadvantages associated with each option.
- You have to consider each option and its advantages/disadvantages before you choose the algorithm you want to continue developing into your program.

Programming Algorithm Example

Simple steps representing a process for dealing with a guessing game in which the computer generates a random number and the player guesses.

1. Generate a secret random number between 1 and 100.
2. Get a number from the player.
3. Compare the player's guess to the secret number.
4. Compare the numbers. If the numbers are identical, go to step 5. Otherwise, tell the player the number was either too high and return to step 2.
5. Display a message stating the secret number was guessed.

Pseudocode

- ***Pseudocode*** is a mix of English language and code that represents what you want your program to do.
- It helps you determine how you want the program to work as well as what variables and methods/functions you will want to include.
- Developing pseudocode will help you work through your logic, reducing the number of errors and potential re-writes you will have to do.

Pseudocode Example

Represents the same process for dealing with a guessing game in which the computer generates a random number and the player guesses the number

```
btnCheckGuess_Click()  
    randomNumber = 37  
    Get playerGuess from text box  
    If playerGuess = randomNumber Then  
        Display "Correct"  
    ElseIf playerGuess < randomNumber Then  
        Display "Guess too Low"  
    Else  
        Display "Guess too High"  
    End
```


Flowchart

- A third tool in programming is through the use of a ***flowchart***.
- Flowcharts use symbols and text to give a visual representation of a solution to a problem.
- The direction of the arrows indicates the flow of the logic.

Flowchart

- Flowcharts help the programmer begin to plan the programming project.
- They provide a **visual representation** of the algorithm or process.
- They describe the inputs, processes and outputs of the program that are needed to successfully complete the project.

Flowchart Symbols

- There are many flowchart programs, however you can also use Microsoft Word to create a flowchart – or just a piece of paper and a pencil.
- To create the flowchart, there are different symbols that represent the various parts. We will only use a few of these symbols.
- Use lines with arrows to indicate flow of control.
- The text in your flowchart symbols is your pseudocode.

Flowchart Symbols



Start/End

Ovals : Start should always be the first shape, with a End at the end of the flow chart or a process.

Input/Output

Parallelogram: This shape is used to show raw materials used for 'ingredients' and to show the finished product. Input/Output – Get/Display

Processes

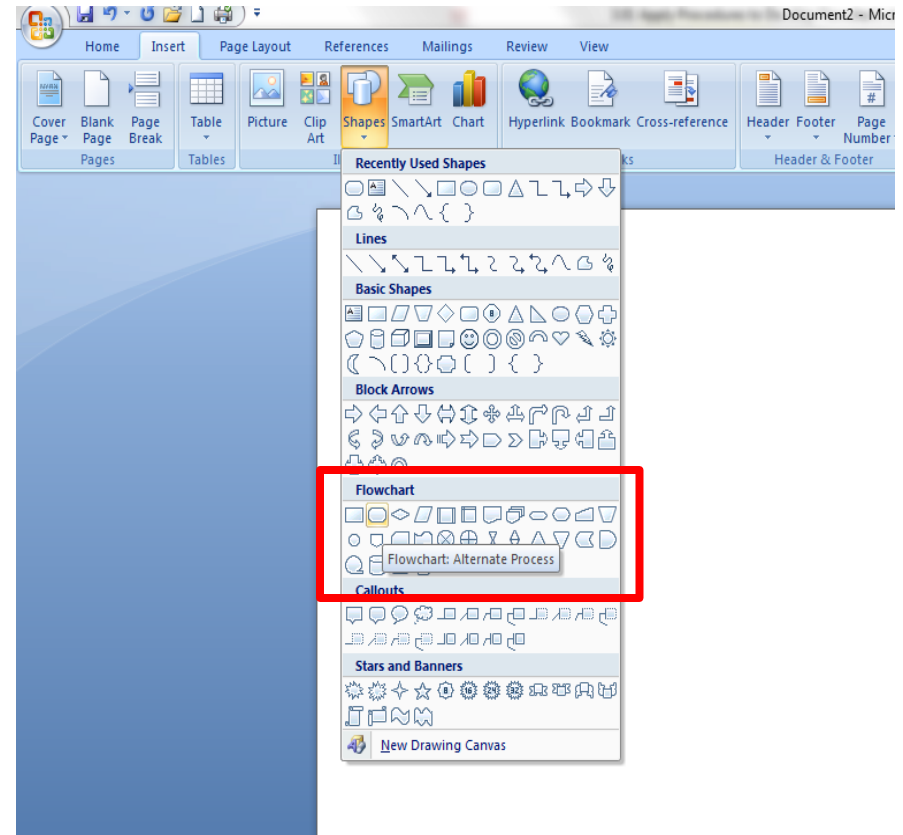
Rectangles should be used to show processes/commands, eg. 'Bake Cake'. These are activities.

Decisions

Diamonds: Hold questions that resolve into True or False. Used for **decisions** that divide into two options and to control **loops**.

Using Microsoft Word to Create a Flowchart

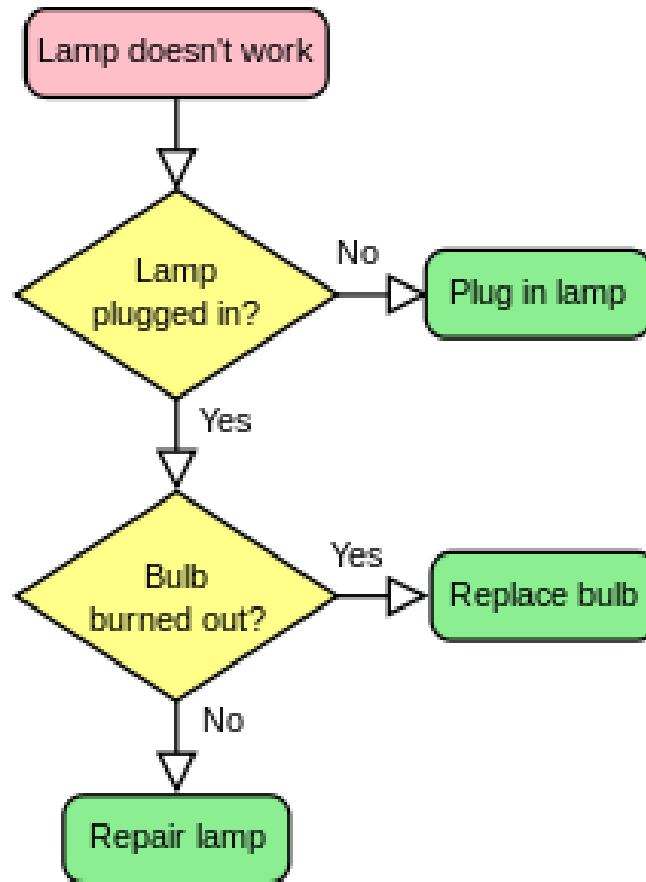
- Open Microsoft Word.
- Under Insert choose Shapes
- Look down the list until you see Flowchart.
- Hover your mouse over a shape, you will see a popup telling you what that shape is used for.



Using Microsoft Word to Create a Flowchart

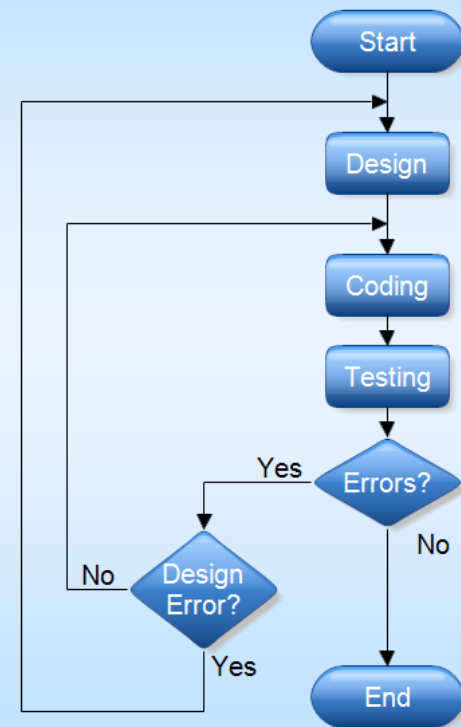
- Select and draw the shapes needed for your program logic.
- Once you draw a shape you can right click and select Add Text to enter information into your symbol.
- Join your symbols using arrows indicating program data flow.

Flowchart Examples



<http://en.wikipedia.org/wiki/Flowchart>

Software Development



http://www.rff.com/software_development.htm

Expectations

- Some general rules:
 - If you do not understand the problem, you probably will not be able to create a solution.
 - Remember to start with the solution in mind.
 - Your program solution should not necessarily look like that of another programmer.
 - Use your tools to help you determine your solution.