Programming

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Objectives

- After viewing this presentation, the learner will be able to…
  - Given a task, create pseudocode
  - Given pseudocode, create a flowchart
  - Define/describe these terms: *program, compile vs. interpret, loop, variable, function, syntax, code, debug, IF THEN ELSE*

What is programming?

- Series of instructions to a computer to accomplish a task
- Instructions must be written in a way the computer can understand
- Programming languages are used to write programs

What is programming?

- Once the code (language) of a program has been written, it must be executed (run, started).
- You may need to type the name of the program to start it, or use a word like RUN and the name of the program (in the old days, anyway).

What is programming?

- Some programming languages (like Java or C++) require the code to be *compiled* (translated to binary) before it can be started.
- Others (like JavaScript) are *interpreted*, meaning that each command is translated separately when the program is started.

What is a programming language?

- Set of commands that a computer has been "taught" to understand
- Languages that look like "machine code" (e.g., 82A8: jsr r5,@#82AE 82AC: sob r0,8296) are used for…
  - Writing games
  - Writing application programs (like Excel)
- Other languages look like English ("high level," e.g., PRINT "HELLO")
  - Logo
  - JavaScript
  - And many more

What does programming look like?

- Here are some examples of an instruction to print the word HI
  - Logo PR [HI]
  - JavaScript alert(“HI”);
  - FORTRAN PRINT “HI”
  - BASIC PRINT “HI”
  - COBOL DISPLAY ‘HI’.
  - C++ printf(“HI”);
  - Pascal WRITELN(‘HI’);
  - Assembly Language XPRNT MESSAGE1
MESSAGE1 DC ‘HI’

How do you write a program?

- Decide what steps are needed to complete the task
- Write the steps in *pseudocode* (written in English) or as a *flowchart* (graphic symbols)
- Translate into the programming language
- Try out the program and “debug” it (fix if necessary)

What is pseudocode?

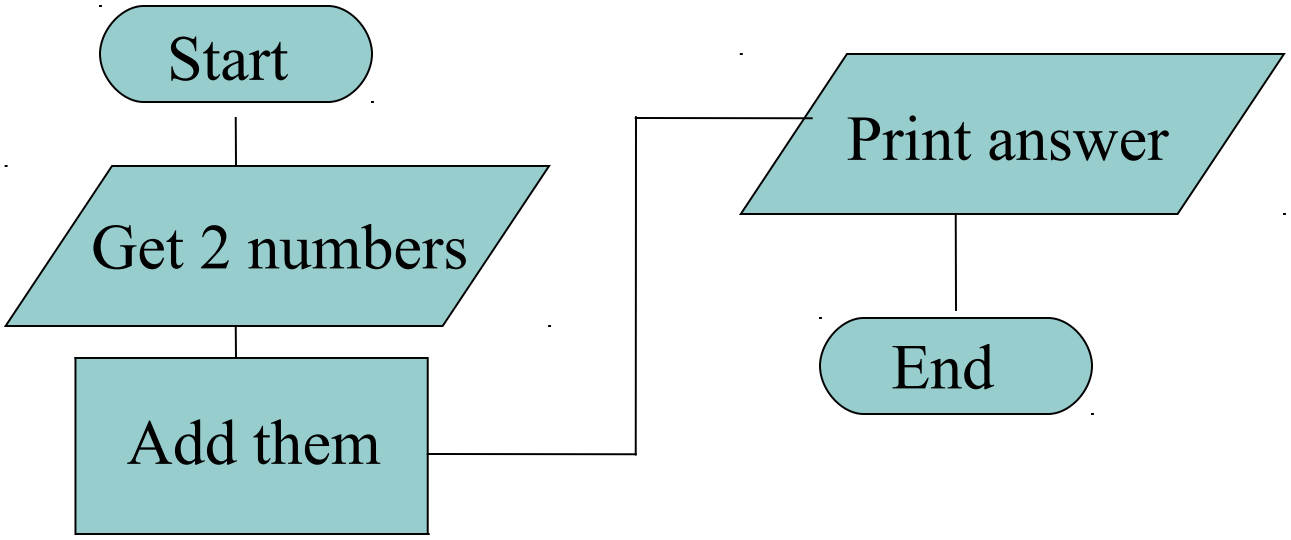
- List of steps written in English
- Like the instructions for a recipe
- Must be in the right sequence
  - Imagine saying “bake the cake” and then “mix it up”

Sample Pseudocode

- Task: add two numbers
- Pseudocode:
  - Start
  - Get two numbers
  - Add them
  - Print the answer
  - End

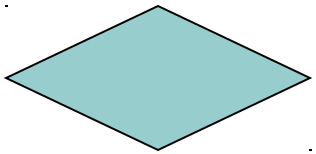
What does a flowchart look like?

- The pseudocode from the previous slide would look like this as a flowchart:



What are those funny symbols?

- START/END
- INPUT/OUTPUT
- PROCESS
- DECISION



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- START/END
- Used at the beginning and end of each flowchart.

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- INPUT/OUTPUT
- Shows when information/data comes into a program or is printed out.

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- PROCESS
- Used to show calculations, storing of data in variables, and other “processes” that take place within a program.

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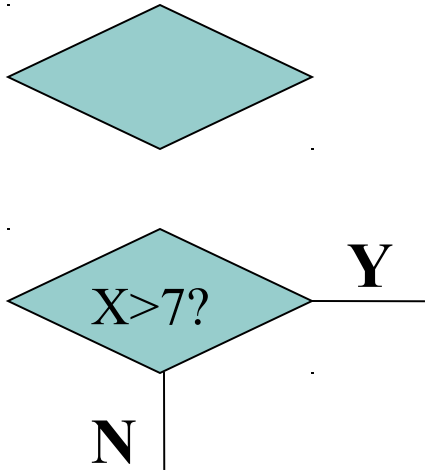
- DECISION
- Used to show that the program must decide whether something (usually a comparison between numbers) is true or false. YES and NO (or T/F) branches are usually shown.



Another Sample: Calculating Age

- Pseudocode:
  - Start
  - Get year born
  - Calculate age
  - Print age
  - If age > 50 print OLD
  - End

Another Sample: Calculating Age

- Flowchart→
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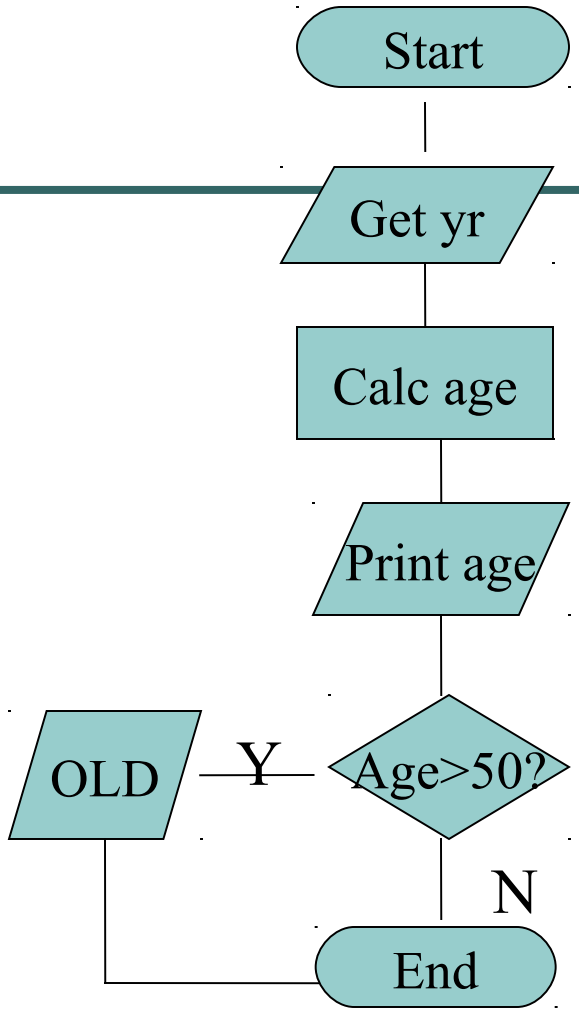

Elements of a Program

- All programming languages have certain features in common. For example:
  - Variables
  - Commands/Syntax (the way commands are structured)
  - Loops
  - Decisions
  - Functions
- Each programming language has a different set of rules about these features.

Variables

- **Variables** are part of almost every program.
- A variable is a “place to put data” and is usually represented by a letter or a word. (Think of a variable as a Tupperware container with a label on it.)
- Variable names cannot contain spaces.
- Some programming languages have very specific limits on variable names.

Variables

- Usually there are several ways to put information into a variable.
- The most common way is to use the equal sign (=).
- X = Y + 7 means *take the value of Y, add 7, and put it into X*.
- COUNT=COUNT + 2 means *take the current value of COUNT, add 2 to it, and make it the new value of COUNT*.

Variables

- Sometimes you must specify the type of data that will be placed in a variable.
- Here are some examples of data types:
  - Numeric (numbers of all kinds)
  - String (text, “strings of letters”)
  - Integer (whole numbers)
  - Long (large numbers)
  - Boolean (true/false)

Variables

- Variables may be classified as *global* or *local*.
- A *global* variable is one that can be shared by all parts of a program, including any functions or sub-programs.
- A *local* variable is one that is used only within a certain part of the program, for example, only in one function or sub-program.

Commands/Syntax

- Programming languages are truly languages.
- They have rules about grammar, spelling, punctuation, etc.
- You need to learn the rules of a programming language, just as you learned to speak and write English.

Loops

- A **loop** is a repetition of all or part of the commands in a program.
- A loop often has a counter (a variable) and continues to repeat a specified number of times.
- A loop may also continue until a certain condition is met (e.g., until the end of a file or until a number reaches a set limit)

Decisions

- You saw a flowchart symbol for **decisions**.
- A program often needs to decide whether something is true or false in order to see which way to continue.
- Programs often use IF (or IF THEN or IF THEN ELSE) statements to show a decision.

Decisions

- An IF statement always has a condition to check, often a comparison between a variable and a number.
- The IF statement also must specify what to do if the condition/comparison is true.
- These instructions (for “true”) may come after the word THEN, or they may simply be listed.

Decisions

- In an IF THEN statement, when the condition is false, the program simply ignores the THEN commands and continues to the next line.
- In an IF THEN ELSE statement, commands are given for both the true and false conditions.

Functions

- In most programming languages, small sub-programs are used to perform some of the tasks.
- These may be called functions, subroutines, handlers, or other such terms.
- Functions often have names (e.g., getName or CALCTAX).

Functions

- A **function** generally gets information from the main program, performs some task, and returns information back to the program.
- Functions follow the same rules of syntax, etc. as the main program.
- JavaScript code is primarily made of a series of functions.

Hints for Writing Code

- “Code” means writing the program in the appropriate language
- Be sure the code is exact (spelling, capitals/lower case, punctuation, etc).
- Write part of the code, try it, then write more.

Debugging

- To “debug” means to try a program, then fix any mistakes.
- Virtually no program works the first time you run it. There are just too many places to make errors.
- When you are debugging a program, look for spelling and punctuation errors.
- Fix one error at a time, then try the program again.

Self-Check

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  - A series of instructions to accomplish something
  - A TV show
  - Written in Egyptian hieroglyphics
  - Can be written any way you want to

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  - Translate it into English
  - Translate it into binary code
  - Pile up the punch cards used for the program
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  - The results of a program that makes secret codes
  - The logic of a program written in English
  - The logic of a program shown in a chart

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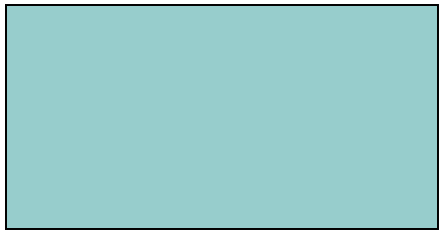

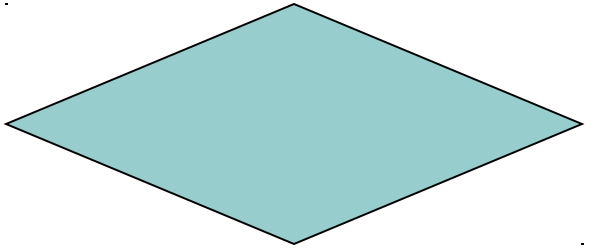

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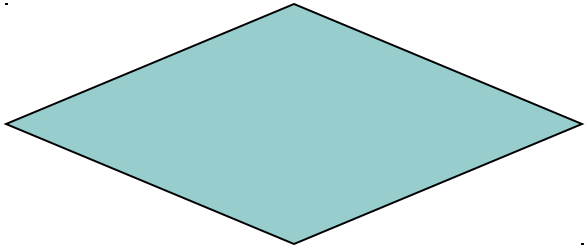

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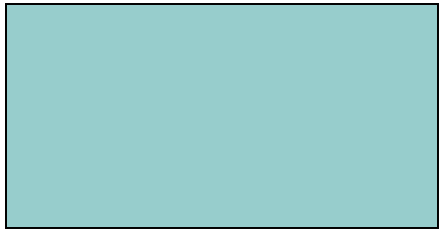

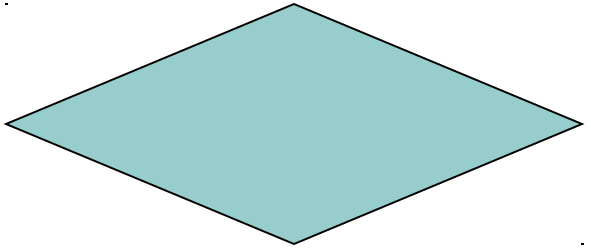

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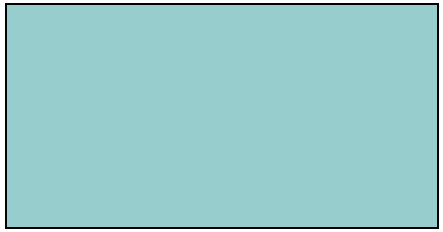

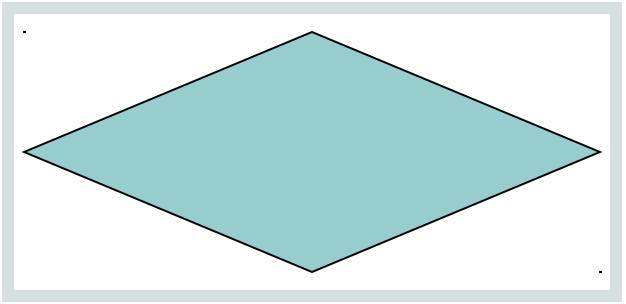

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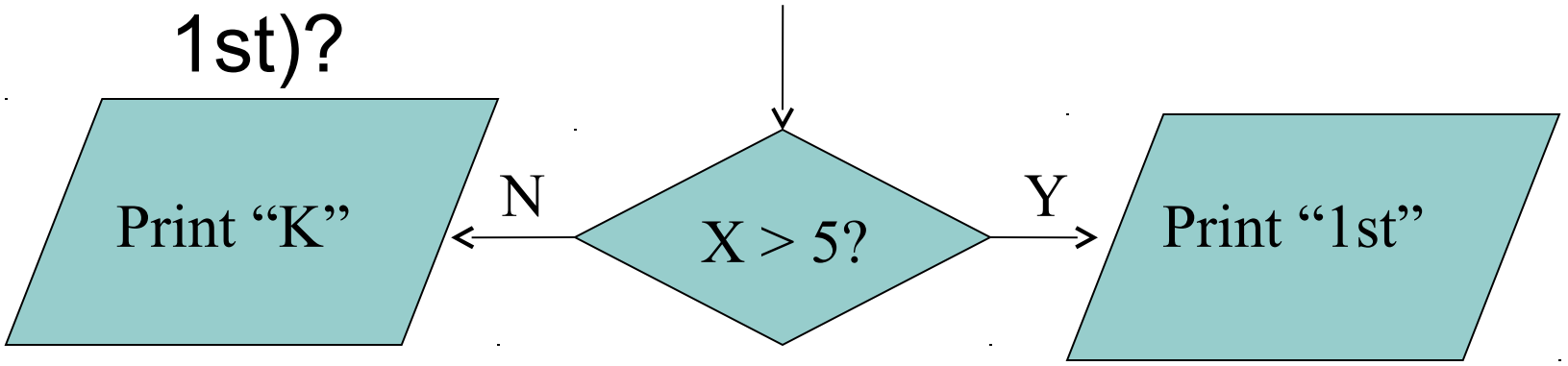

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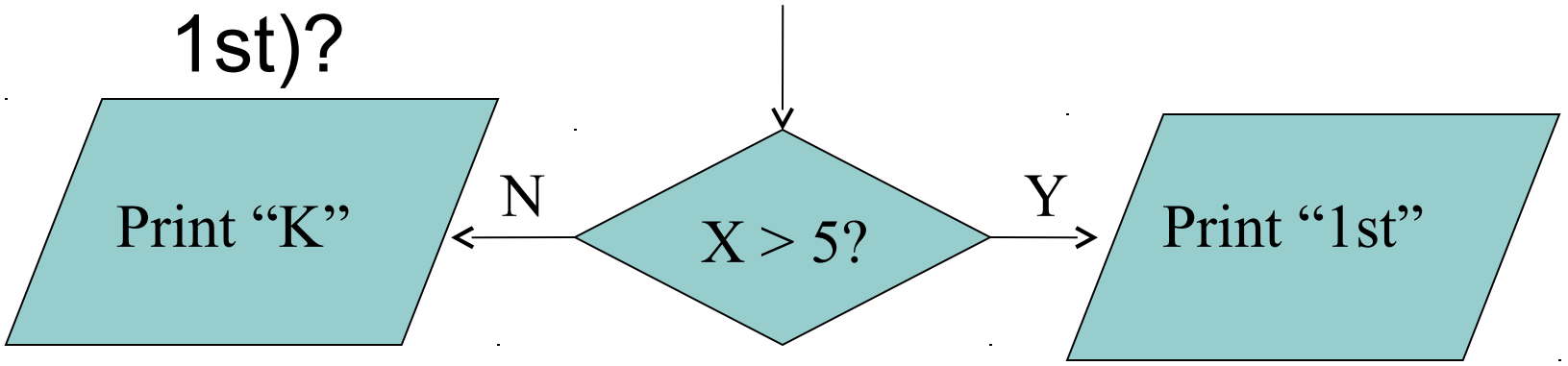
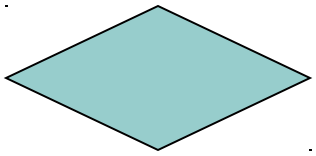


K will be printed. The answer to the question "Is X greater than 5?" is NO, since X is equal to (not greater than) 5.

Self-Check

- Choose the correct flowchart symbol for each of these statements.
- AGE>65?
- Calc. Tax
- START
- Print NAME



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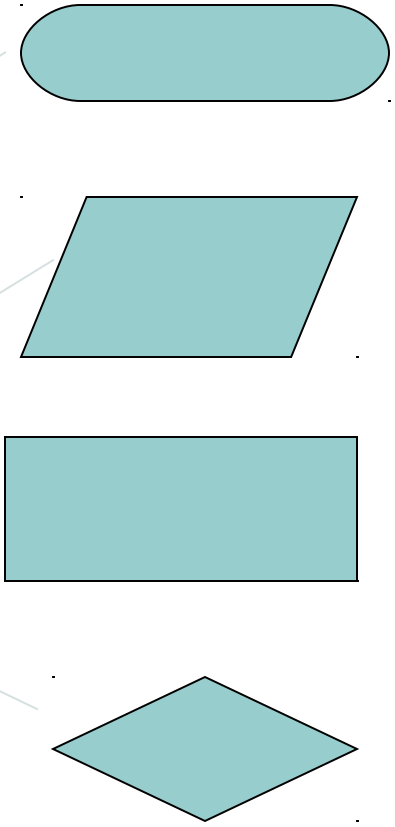

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Challenge

- Try to write pseudocode and create a flowchart for a program that calculates the average of three grades and prints the average.
- The word GOOD should be printed only if the average is more than 80.

Challenge

- Possible pseudocode
  - Start
  - Get three grades
  - Average them
  - Print Average
  - Average>80?
    - If Yes, print GOOD
  - End

Challenge

- Possible flowchart→
  - Start
  - Get three grades
  - Average them
  - Print Average
  - Average>80?
    - If Yes, print GOOD
  - End