Unit 1: Problem Solving

Part 2: Flowchart Decision Blocks

Topic 2: Creating Algorithms

Lecture Contents

- Review of *Understanding Algorithms*
  - Definition, examples, flowcharts
- Vocabulary
- Naming Conventions
- Creating Algorithms
  - Flowcharts (more symbols)
- Reading: pages 12 to 14

Algorithm - Definition

- Algorithm: an ***unambiguous sequence*** of steps to solve a problem or perform a task.
  - ***Unambiguous*** : clear and precise with no room for misinterpretation
  - ***Sequence*** : and *ordered* set
- The result of following a *successful* algorithm should always be the same (***consistency***)

  (given the same input)

Algorithm – Examples

Ingredients:

- *4 large eggs*
- *2 tablespoons of milk or cream (optional)*
- *Salt and pepper to taste*
- *1 tablespoon of butter*
- *Optional: shredded cheese, chopped herbs (like chives or parsley), or a dash of hot sauce*

Instructions:

Crack the Eggs: *Break the eggs into a bowl. If you prefer, add the milk or cream for a creamier texture. Season with a pinch of salt and pepper.*

Whisk: *Use a fork or a whisk to beat the eggs until the yolks and whites are fully combined.*

Heat the Pan: *Place a nonstick skillet over medium-low heat and add the butter. Let it melt and coat the bottom of the pan.*

Cook the Eggs: *Pour the beaten eggs into the skillet. Let them sit for a few seconds until they start to set around the edges.*

Stir Gently: *Using a spatula, gently stir the eggs, pushing them from the edges toward the center. Continue to cook, stirring occasionally, until the eggs are mostly set but still slightly runny.*

Finish Cooking: *Remove the pan from the heat just before the eggs are fully cooked, as they will continue to cook from the residual heat. If you're adding cheese or herbs, sprinkle them in now and give a final gentle stir.*

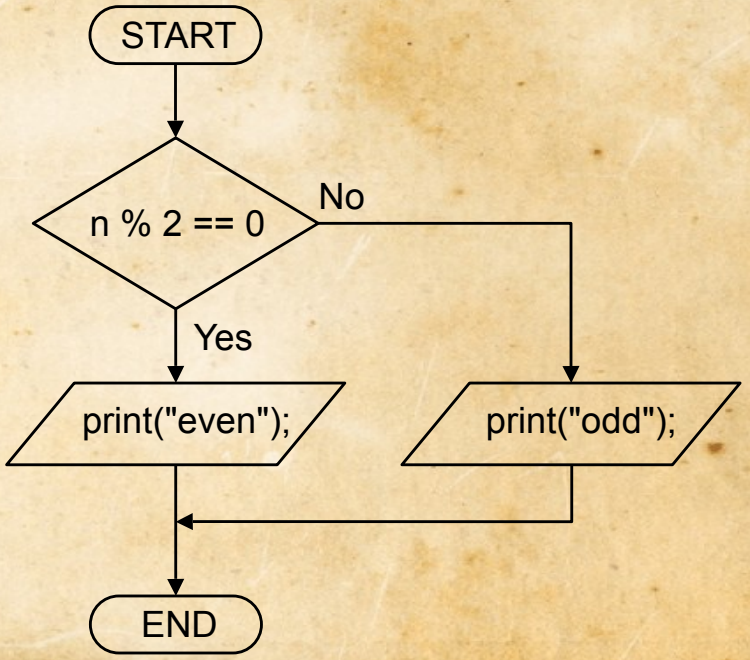
Serve: *Transfer the scrambled eggs to a plate and enjoy immediately.*

Algorithm – Examples

- From the textbook: Making a cup of coffee
  - Fill the kettle with water.
  - Turn on the kettle.
  - Place coffee in a cup.
  - Wait for the water to boil.
  - Pour water into cup.
  - Add milk and sugar.
  - Stir.

Flowcharts

- Flowcharts are a diagrammatic way to show an algorithm.
- The visual aspect may aid in understanding



Flowchart Symbols

- You should be familiar with the following symbols:
  - **Flowlines**

    - Maximum one output from any block
  - **Terminal** (start/end)

    - Start only output, end only input
    - Diagram might not have an end
  - **Processes**

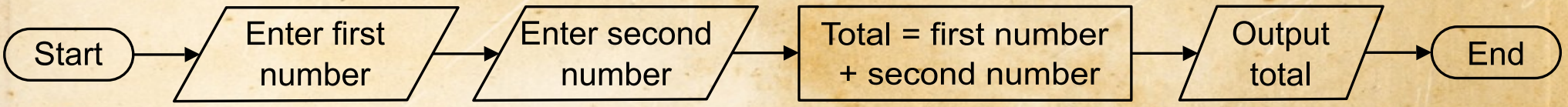
    - Action (verb)

Flowchart Symbols – Input / Output

- Input/Output
  - Parallelogram
  - Manual operation is needed
  - Examples:
    - Check the sensor
    - Output Result

Flowchart Symbols – Input / Output

- Hopefully the use of the symbol is pretty self-explanatory
  - Simple example:

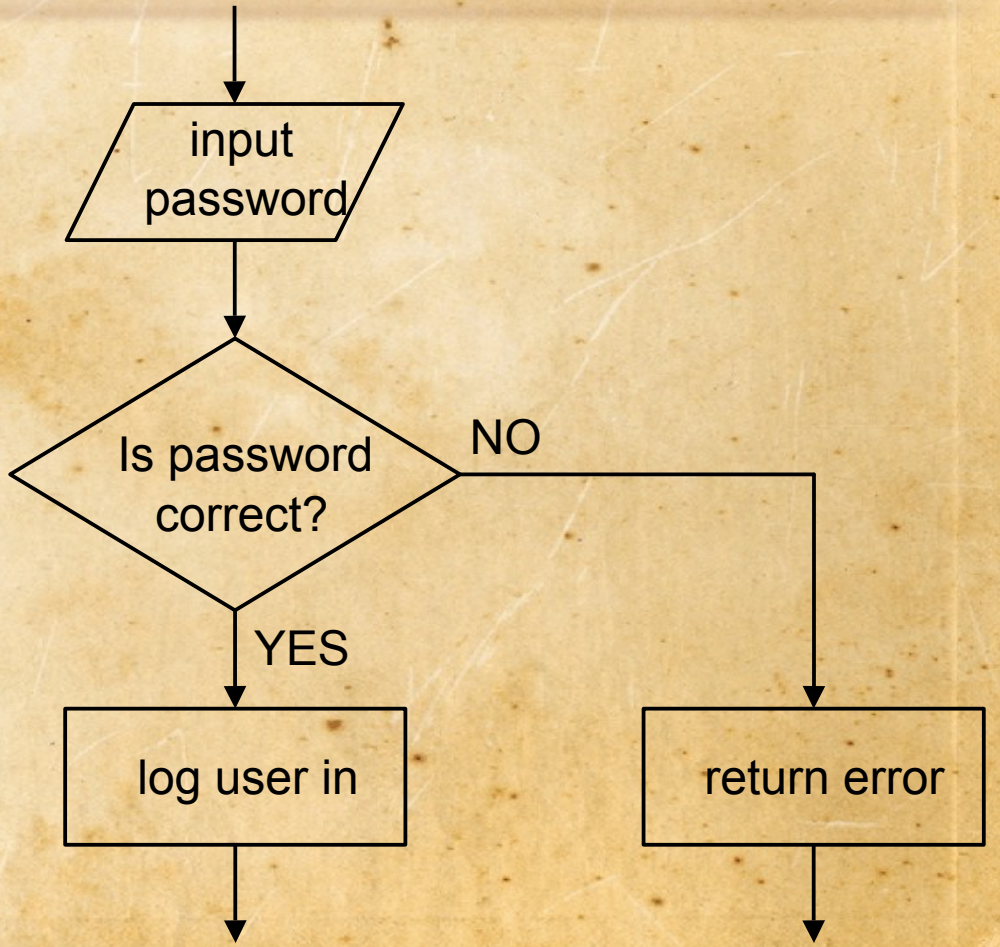


Flowchart Symbols – Decision

- Decision
  - Rhombus
  - Outcome is either “yes” or “no”
    - Two output flowlines
  - Examples:
    - Is the result zero?
    - Have we reached the count limit?

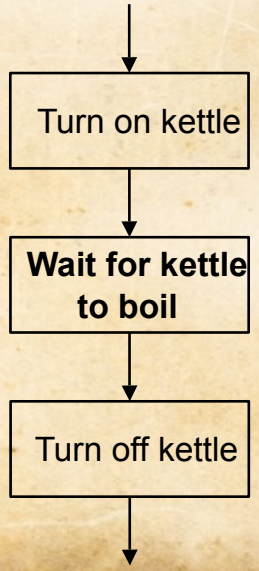
Flowchart Symbol – Decision

- Decision blocks allow us to make a choice
  - The question should have two alternatives (a yes/no question)
  - This construct is called ***selection***.



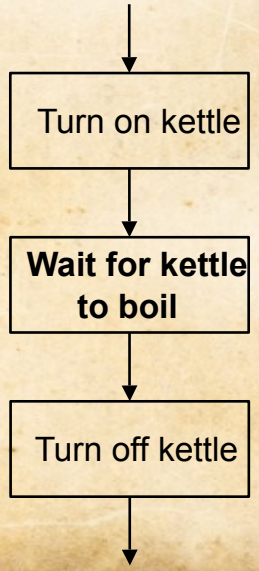
Flowchart Symbols – Decision

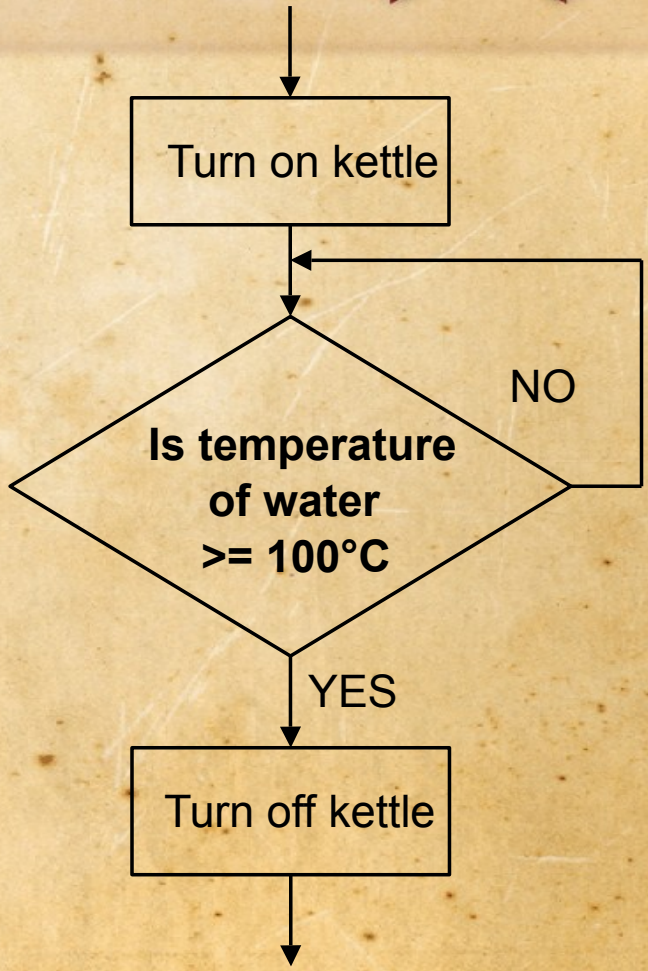
- What does it mean to “wait for kettle to boil”?



Flowchart Symbols – Decision

- What does it mean to “wait for kettle to boil”?
  - Repeatedly check the temperature.
  - This construct is called ***iteration***.
    - Decision block loopback





Algorithm – Example

- Draw a flowchart that represents an algorithm that:
  - Prompts a user to input their name, then greets them with a hello message using their name.
  - Inputs three numbers (x, y, z) and outputs the average of those three.
  - Inputs three numbers (x, y, z) and outputs the largest of those three.
  - Inputs an integer, x, and outputs all *even* numbers between 0 and x (assume that x is positive).
  - Taking class attendance.

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