

# Problem Solving

## Algorithms and Flowcharts



# Lecture Contents

- Understanding Algorithms
  - Definition
  - Examples
  - Flow Chart
  - Practice
- Reading: pages 3 to 11
  - We will cover *mathematical operators* later



# Algorithm - Definition

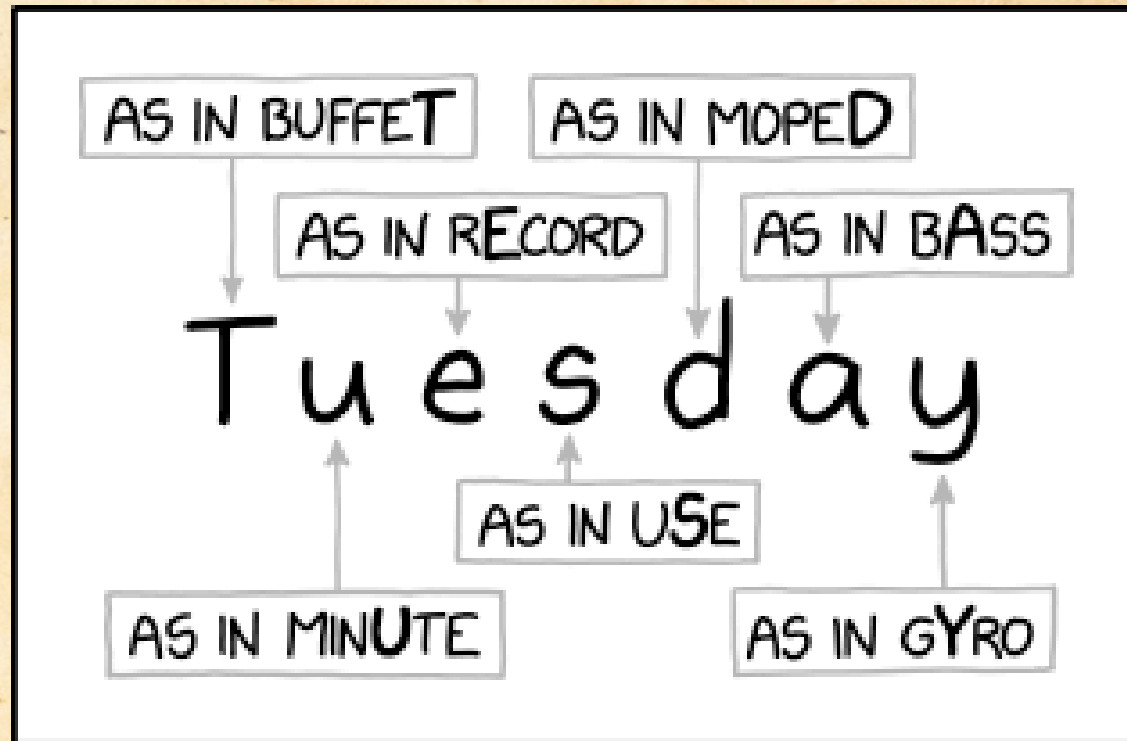
- Algorithm: an ***unambiguous sequence*** of steps to solve a problem or perform a task.
  - ***Unambiguous*** : clear and precise with no room for misinterpretation
  - ***Sequence*** : and *ordered* set



# 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
  - Most language is ***ambiguous*** :
    - *The mouse is beside the keyboard.*
    - *He looks hot.*
    - *The chicken is ready to eat!*
    - *She loves cooking, her family, and her dog.*
    - *Let's eat, Grandma!*

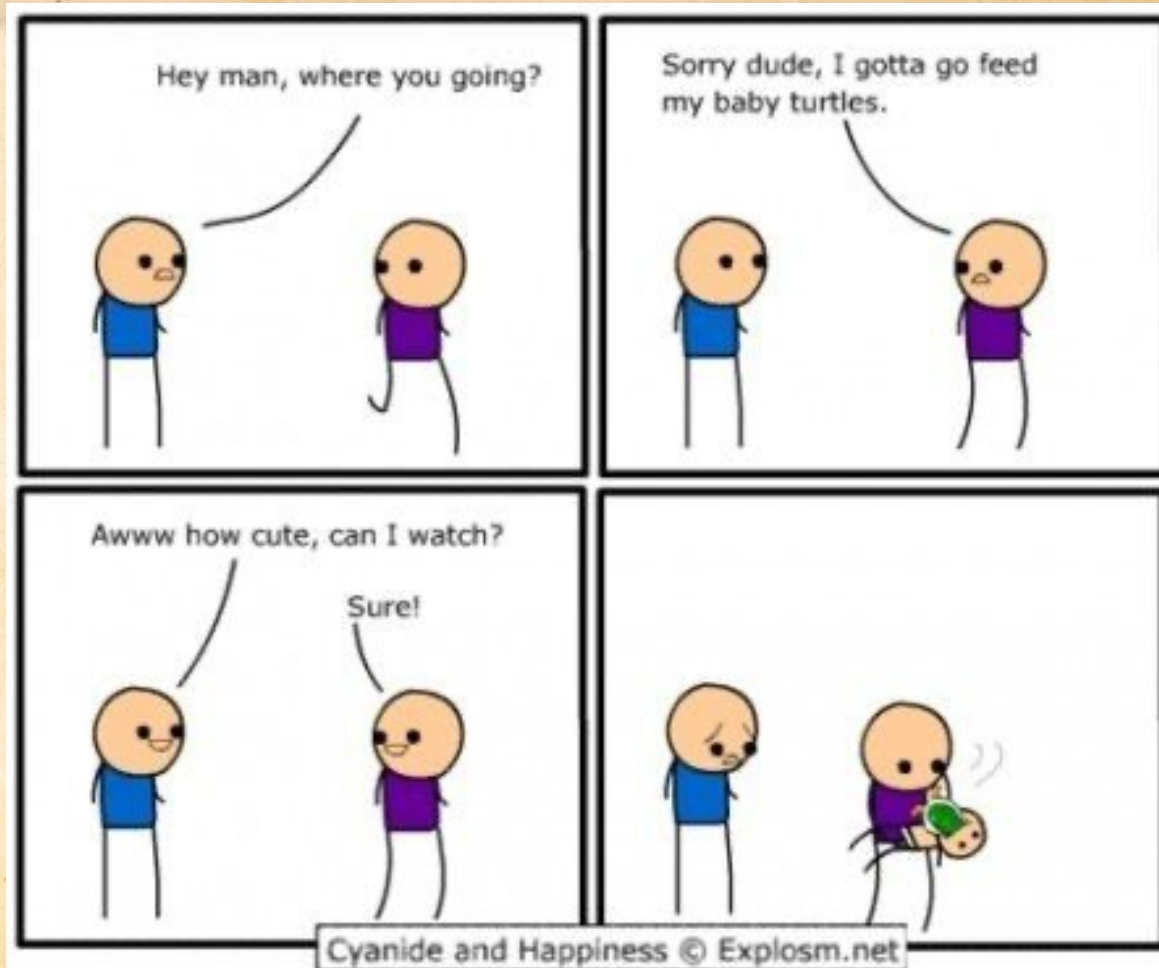
# Algorithm – Definition



PET PEEVE: AMBIGUOUS  
PRONUNCIATION GUIDES



# Algorithm – Definition



# 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
- Characteristics of a successful algorithm:
  - ***Accurate*** – produces the expected outcome
  - ***Consistent*** – produces the same result each time
  - ***Efficient*** – uses little time to complete, and uses few resources
    - Resources include: electricity, CPU cycles, memory space, etc.



# 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.



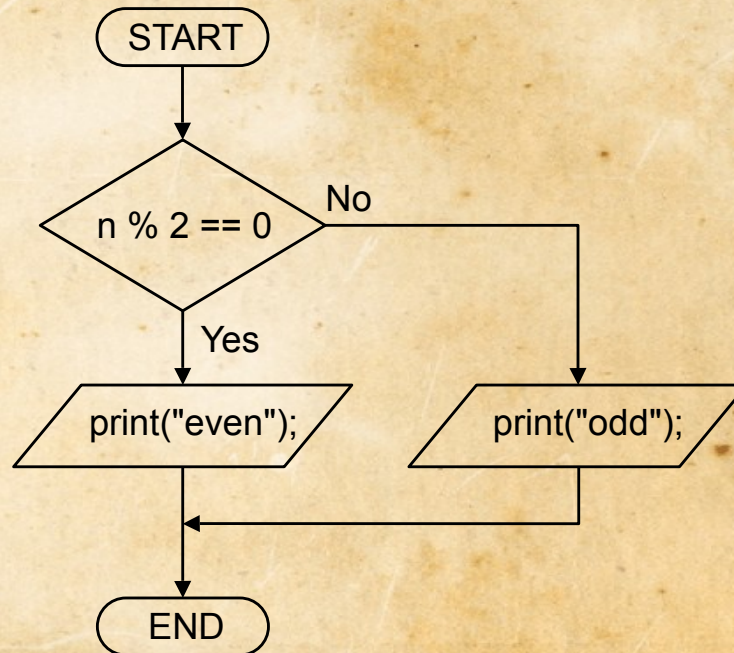
# Algorithm – Examples

- 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.
- Is there any ambiguity?
  - How could the result be different if the same steps are followed?



# Flowcharts

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

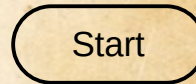




# Flowchart Symbols



- Terminal
  - A rectangle with rounded ends
  - The start/end of the flow chart
    - Not all flow charts will have an end
    - Often the word start / end inside





# Flowchart Symbols



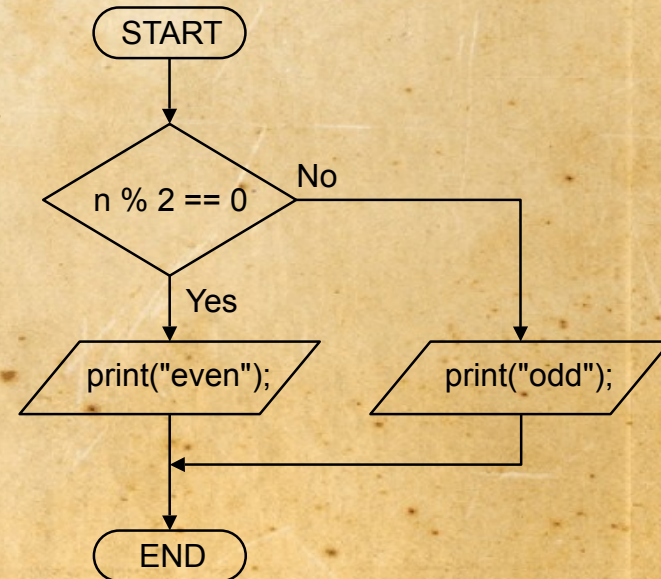
- Process
  - A rectangle (not rounded)
  - Involves action (a verb)
  - Examples
    - Add 1
    - Turn on the motor
    - Place coffee in cup



# Flowchart Symbols

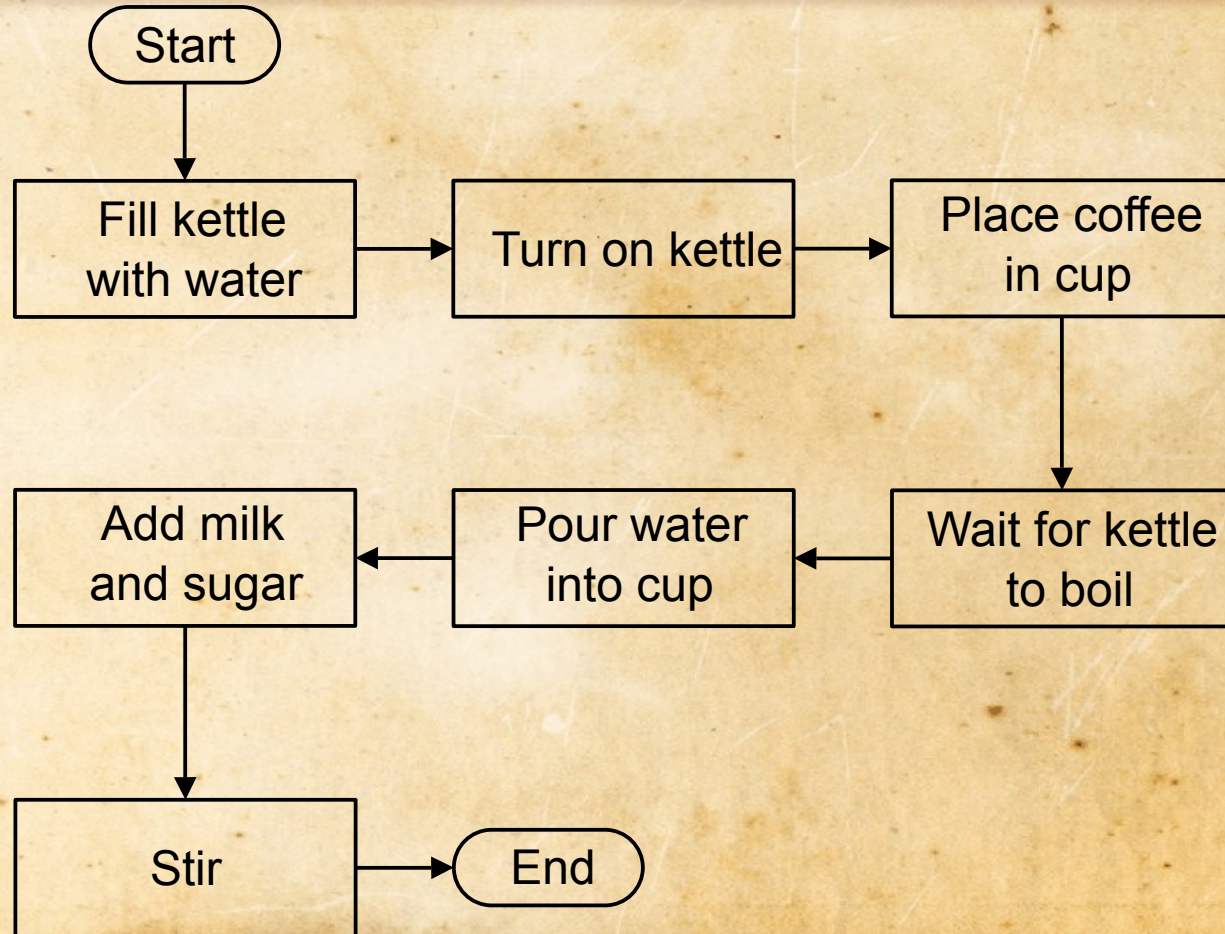


- Flowline
  - Arrow
  - Only **ONE** arrow to represent output from a block, except:
    - Two output flow from a **decision** block
    - No output flow from an **End** block
  - There may be multiple inputs to any block
    - Except *no* inputs to a start block





# Flowchart – Example






# Algorithm – Practice, part 1


- Choose one and write an algorithm (between 5 and 10 steps):
  - Brush your teeth
  - Wash the laundry
  - Fold a shirt
  - Make a sandwich
  - Feed your pet
  - Set the table
  - Stretch before exercise
  - Make a TikTok video
  - Prepare for class
  - Prepare to study for an exam
  - Prepare for the beach
  - Prepare to walk in the rain
  - Organize your books
  - Make scrambled eggs
- Or another idea, but get permission from the teacher first.



# Algorithm – Practice, part 2

- Swap with your classmate and draw their algorithm as a flowchart. Use only the following symbols:

– Terminal (start/end) 

– Flowlines 

– Processes 



# Algorithms - Decomposition

- One more vocabulary word...
- We've been taking tasks and breaking them down into smaller tasks. This is referred to as ***decomposition***. Remember that word as we'll be using it again...



# Problem Solving

## Algorithms and Flowcharts