Algorithms

Flow Charts – Introduction

Lecture Contents

- Understanding Algorithms
  - Definition
  - Examples
  - Flow Chart
  - Practice

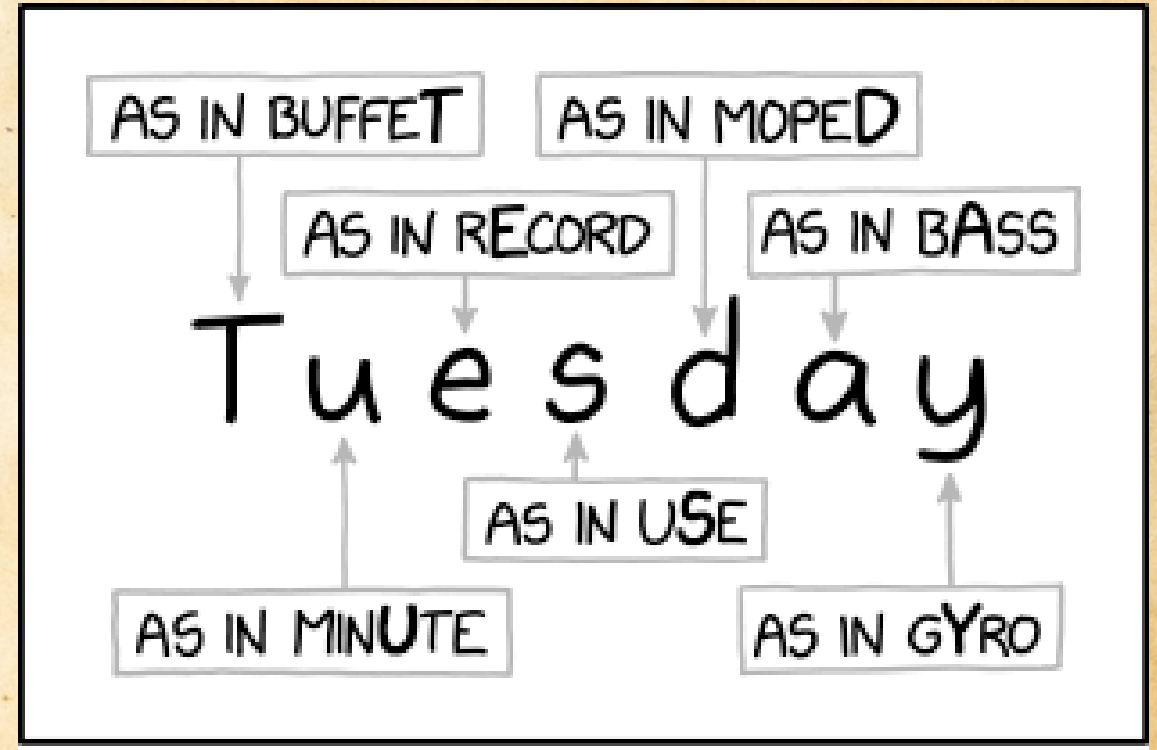
Algorithm - Definition

- 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

- 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.

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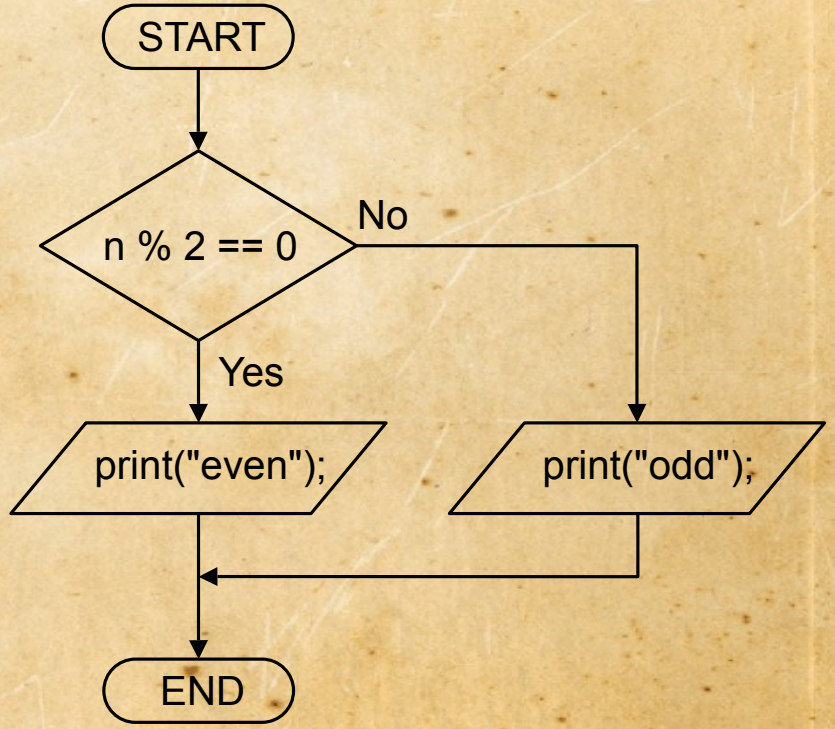
- Is there any ambiguity?
  - How could the result be different if the same steps are followed?

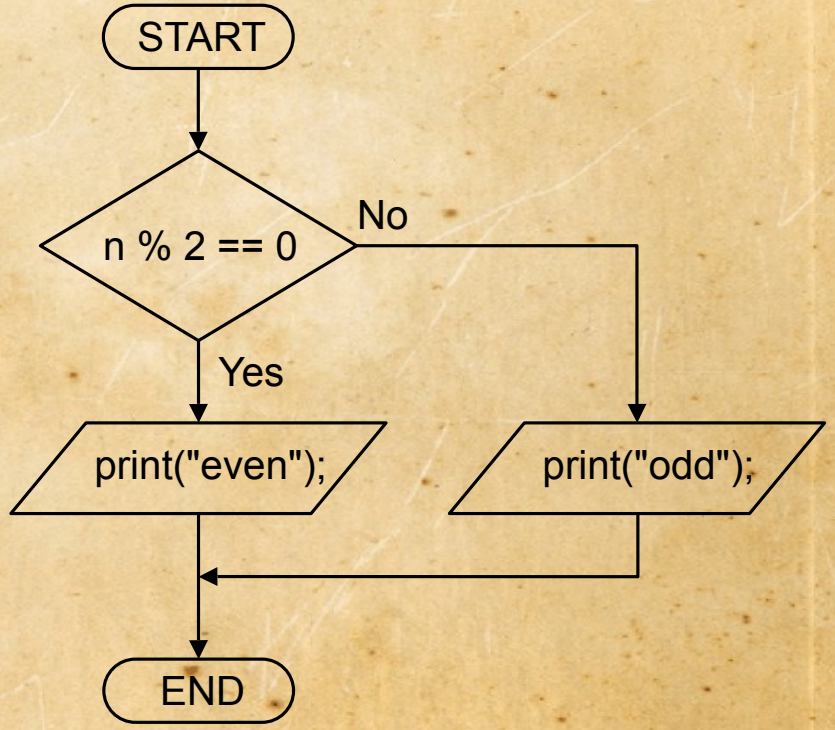
Flowcharts

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



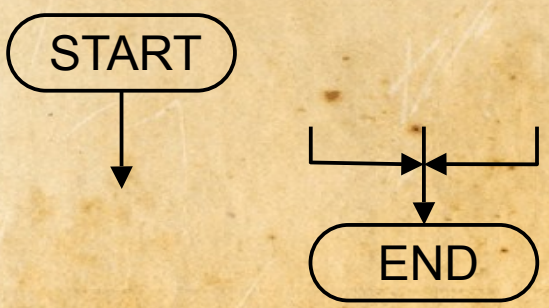
Flowcharts

- Flowcharts are a diagrammatic way to show an algorithm.
- The visual aspect may aid in understanding
- Historically popular for describing computer programs
  - Decreased with the introduction of 3rd generation programming languages
- Standardized symbols: ISO 5807



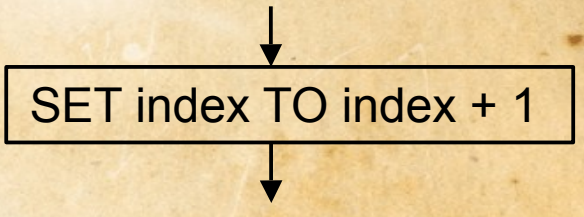
Flowchart Symbols

- 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



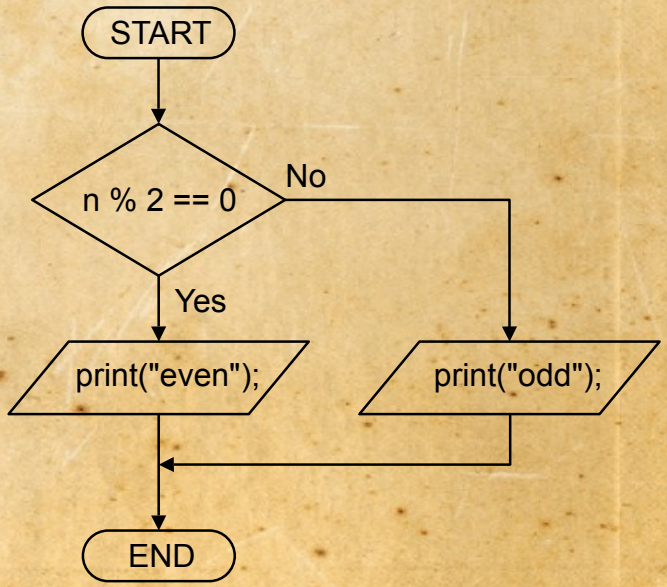
Flowchart Symbols

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

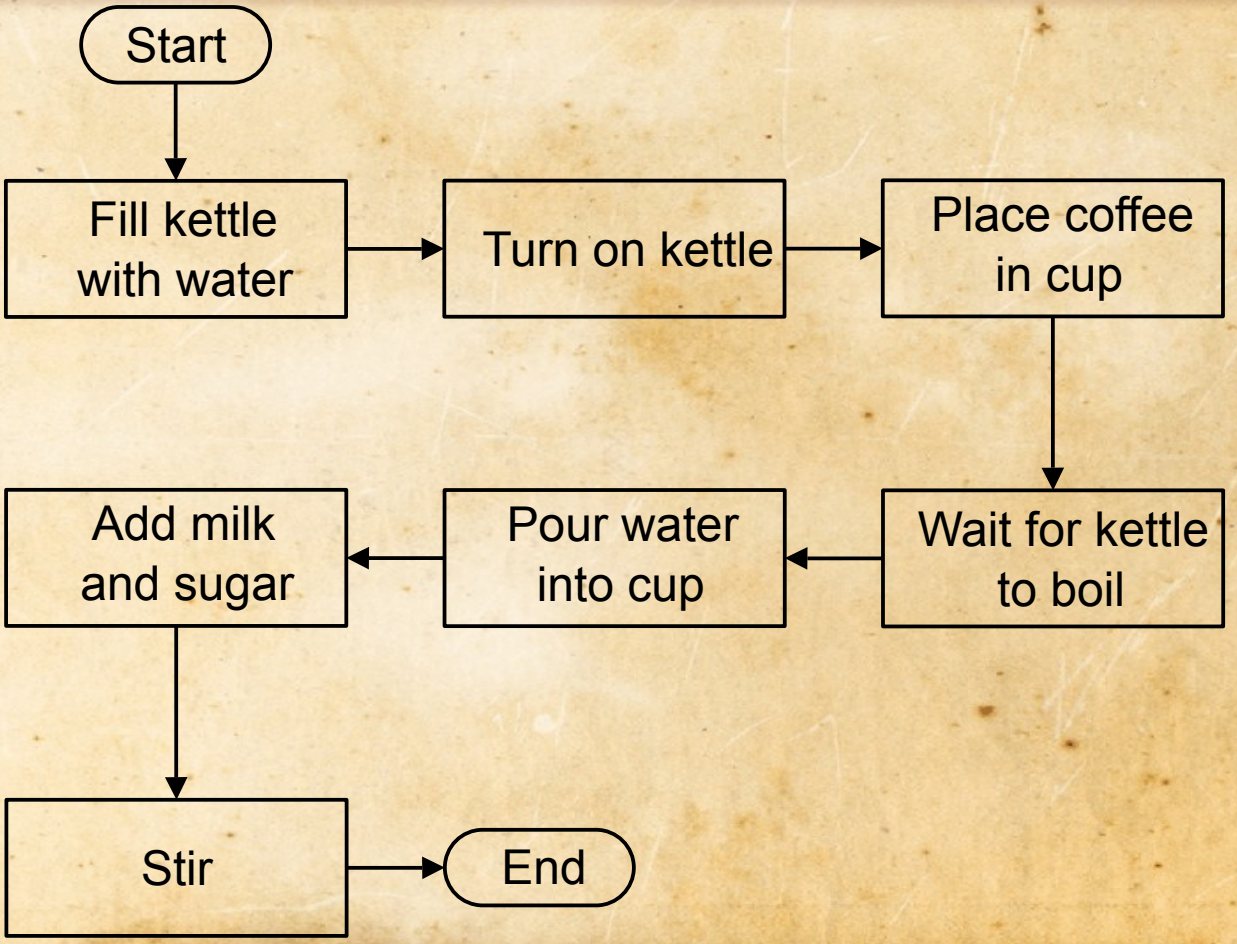


Flowchart Symbols

- Flow line
  - 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

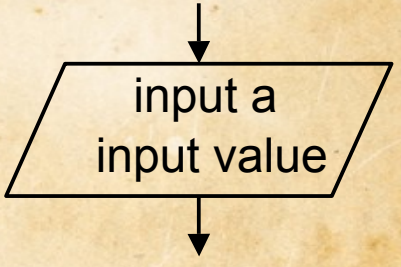


Algorithm – Practice, part 1

- 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.

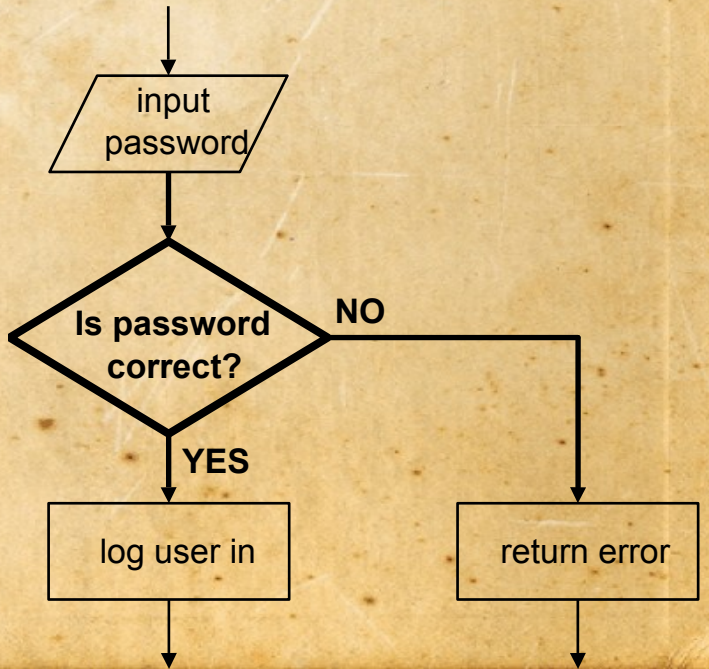
Flowchart Symbols

- Input/Output
  - Parallelogram
  - Examples:
    - Check the sensor
    - Output Result



Flowchart Symbols

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



Exercise

- Draw a flowchart for an algorithm that is for taking class attendance.

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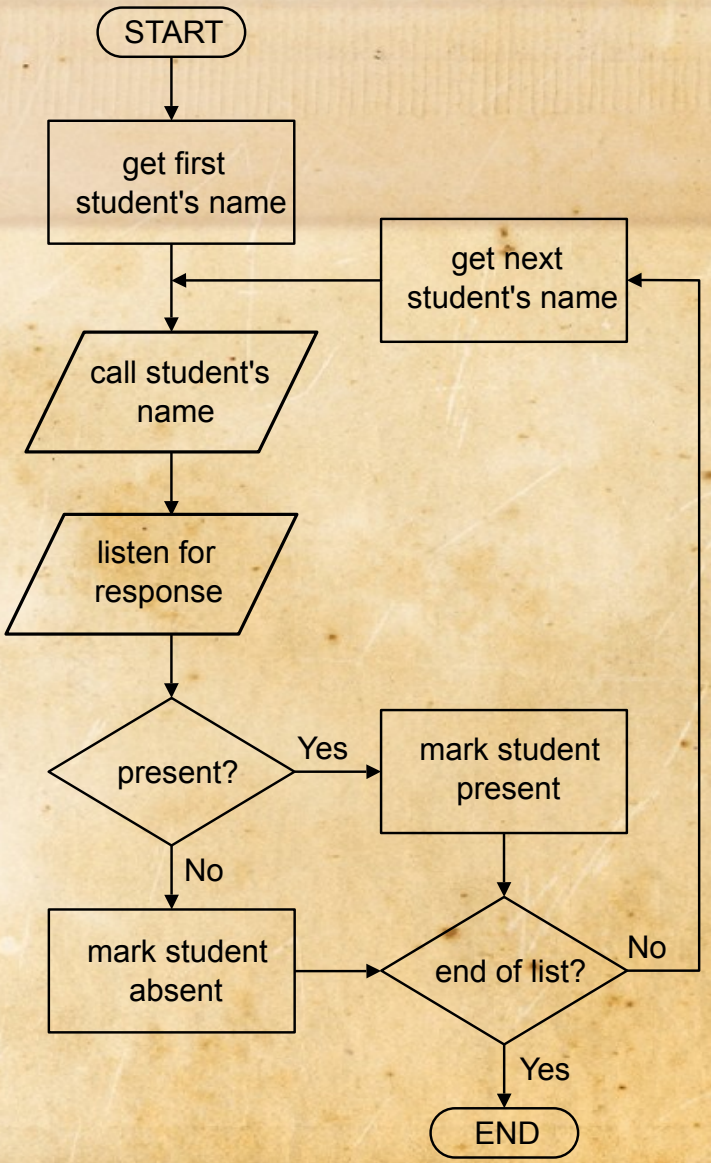

Exercise

- Draw a flowchart for an algorithm that will output a hello message using the user’s name

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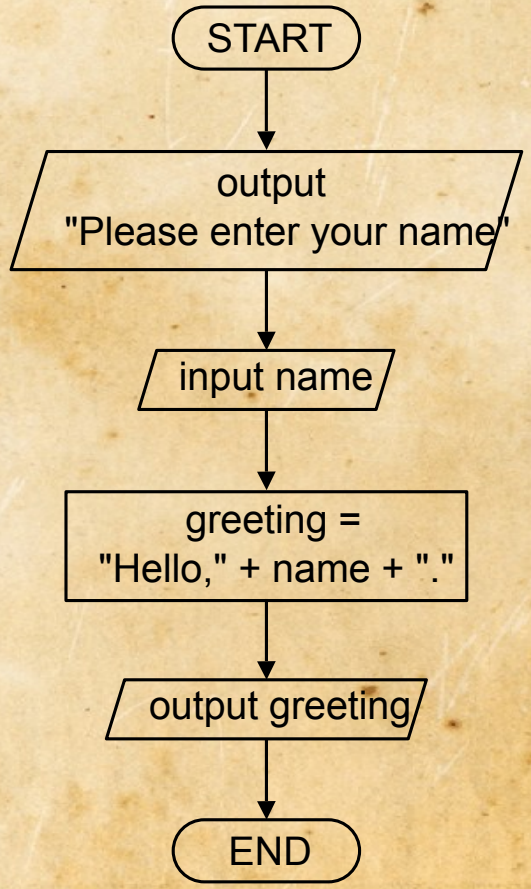

Exercise

- Draw a flowchart for an algorithm that will print whether a number is even or odd

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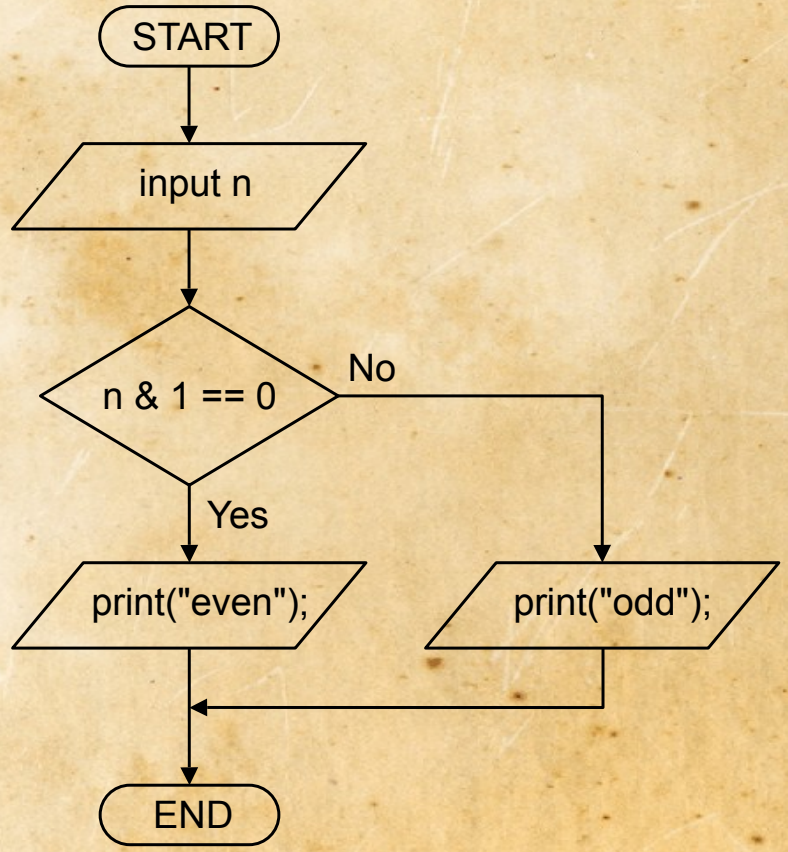


Exercise

- Draw a flowchart for an algorithm that will output the average of three numbers

Exercise

- Draw a flowchart for an algorithm that will count by two, starting from 1 and ending at 9

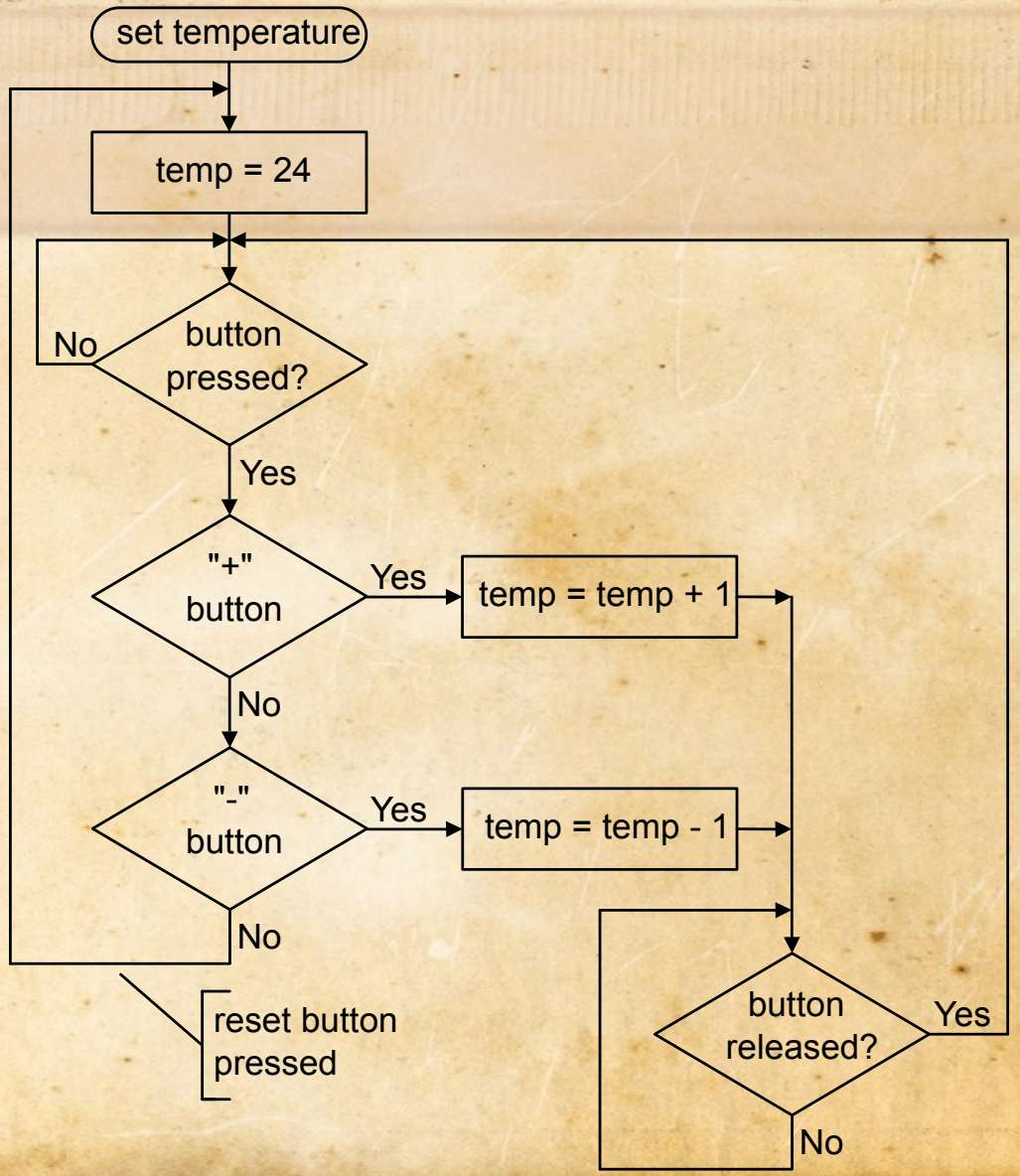
Exercise

- Output the largest of 3 numbers: x, y, and z.

Exercise

- A thermostat has 3 buttons: “+”, “-”, and “*reset*”
- The *reset* button will reset the thermostat to 24 degrees.
- The + button will increase the set temperature by one degree
- The – button will decrease the set temperature by one degree

Exercise


set temperature
temp = 24
button pressed?
No
Yes
"+" button
Yes
temp = temp + 1
No
"-" button
Yes
temp = temp - 1
No
reset button pressed
button released?
Yes
No

Exercise

- Read the set temperature from a thermostat,
- Turn on the heater if the actual temperature is one degree (or more) below the set temperature.
- Turn off the heater if the actual temperature is one degree (or more) above the set temperature.

Algorithms

Flow Charts – Introduction