



Algorithms



Algorithms 3: Summary

- Algorithms
- Programming

Algorithms

- Sometimes you need to know how to do something
 - Like making a brownie or finding the greatest common divisor of two numbers
- If you do not know how to do it, you need “instructions” or “directions”
 - Like a recipe or a map with streets and turns on it
- The general term for this is an algorithm

An algorithm is a set of rules that precisely defines a sequence of operations

- What counts as precise can vary
 - A recipe for a master chef is different than for a beginner

Algorithms

- Early algorithms were meant to be precise enough for mathematicians
 - Euclid's algorithm for finding greatest common divisors
 - Eratosthenes's sieve for finding primes
- New mathematics often involved new algorithms and tools to carry them out
 - The abacus was a tool for addition, subtraction, etc.
 - Indians invented negative numbers and the rules to manipulate them
 - Arabs invented algebra and rules for solving equations
- It takes a combination of the concept, algorithms, and tools for a mathematical idea to be useful

Algorithms

- The final (so far) word in tools is the computer
- Charles Babbage designed an early version around 1830-1870
 - Called the Analytical Engine, it was very complex and never really got entirely built
- Ada Lovelace was a partner of Babbage's
 - She wrote the earliest programs for the Analytical Engine
- The nature of the Analytical Engine meant that it could understand and carry out algorithms
 - If they were written in the correct manner
- But what manner is that?

Algorithms

- The answer is that the algorithm had to be in the form of a program

A program is an algorithm that has been spelled out in enough
detail that a machine can carry it out

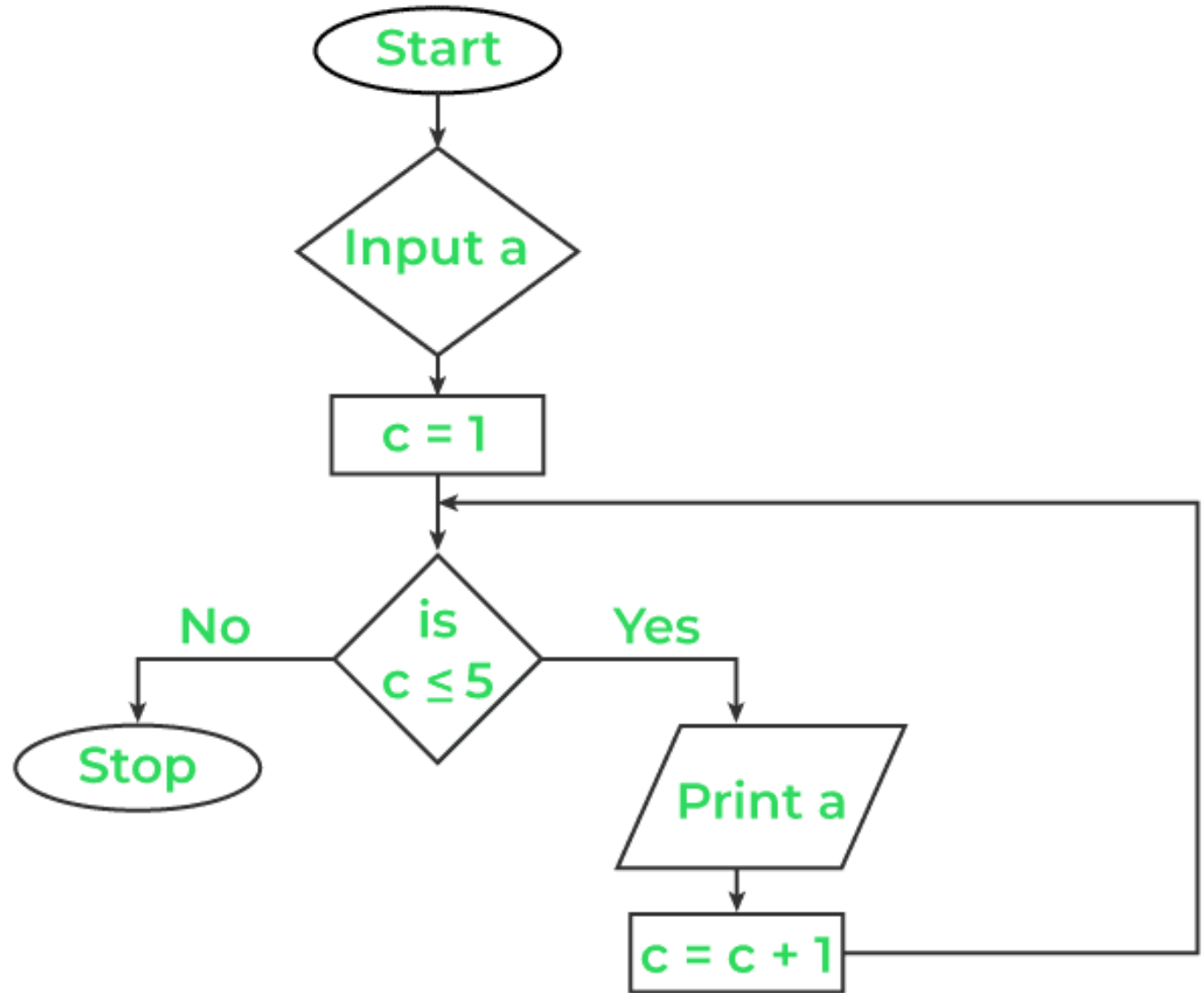
- Programming is the craft of creating programs

Programming

- As soon as programming was invented, two things were discovered
- Programming was hard
 - There were many bugs and they were hard to find and fix
- It was hard to communicate what was going on
 - There was no way to represent a program other than the source code itself
 - Which was hard to read and understand
- Some attempts have been made to address the problems with communication

Programming

Flowcharts are graphical representations of programs



Programming

Pseudocode is text-based
and closer to natural
language

```
MOT1
Program to generate PWM output to Motor

  Initialize
    Outputs
      Motor
    Inputs
      Speed up
      Speed down
      Run enable
    Registers
      Count = 128

  Start loop

    IF Run enable = off THEN wait
    IF Speed up = on THEN inc Count
    IF Count = 0 THEN dec Count
    IF Speed down = on THEN dec Count
    IF Count = 0 THEN inc Count

    Switch on Motor
    Delay for Count

    Switch off Motor
    Delay for 256-Count

  End loop
```