Problem Solving Techniques

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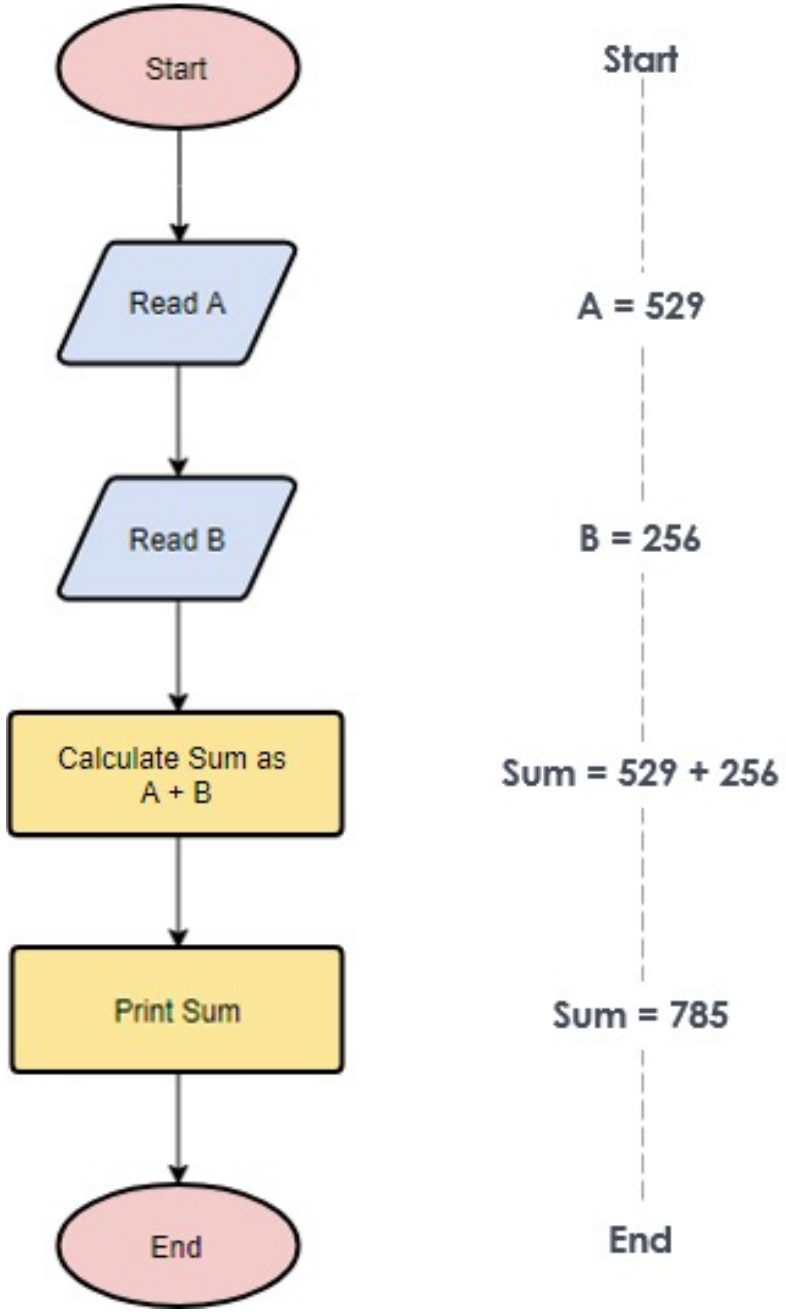
Algorithm

- Solving problems is the core of computer science.
- Programmers must first understand how a human solves a problem, List a series of steps towards the solution in the form of an algorithm, then understand how to translate this "algorithm" into something a computer can do, and finally how to "write" the specific syntax (required by a computer) to get the job done.
- An algorithm is a step-by-step set of operations to be performed or it is a procedure or formula for solving a problem, based on a sequence of specified actions.
- A computer program can be viewed as an elaborate algorithm.
  - Ex : searching / sorting algorithms, Encryption algorithm, Secret key algorithm etc
- A good algorithm should take less memory and perform the task in shortest time

Flowchart

Algorithm

Find the sum of 529 and 256

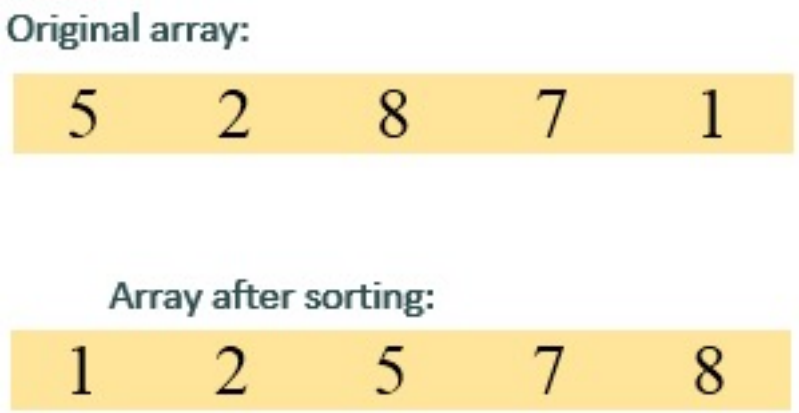


Example – Sorting

- Arrange the given series of numbers in ascending / descending order

  5, 2, 8, 7, 1

- How do we do? What is the algorithm?



Example – Searching

- Search for vowels in the following sentence…..

  “I am a student of Computer Science”

- How do we do? What is the algorithm?

Example – Roots of Quadratic Equation

- Find the roots of the following equation

$$2x^2 - 5x + 6 = 0$$

- How do we do? What is the algorithm?

Example – Reverse a string

- Write the given string in reverse order

"Apple"

- How do we do? What is the algorithm?

More Examples……

- Extract all the prime numbers in a given series of numbers
- Classify the set of numbers as even or odd
- Calculate the interest earned on a bank deposit
- Travelling salesman problem
- Compute GPA, CGPA
- Grade the students, based on marks
- Search for a given number in a series of numbers

Approaches to problem solving….

- Read the problem again and again and again
  - Input, Expected output (Form, font, Pattern etc.)
- Brainstorm until you correctly understand what needs to be done
  - Discuss / debate with team members
  - Never mind wasting time…….Most important
- Solve the problem manually with a few sets of sample data
  - At least 3 sets…..edge cases, corner cases…..
  - Verify if the result is right…….and also cross check
- Optimize the solution
  - Is there any other method which is simpler?
  - Search, Consult and explore….

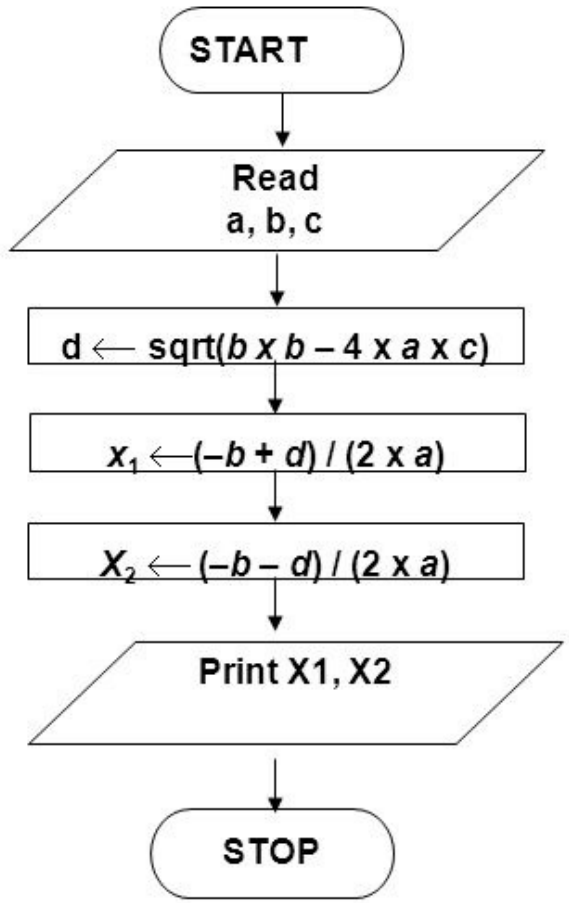
Approaches to problem solving….

- List out the steps involved in an appropriate sequence
- Translate each into real code
  - Use correct syntax…..GIGO principle
- Edit, Compile, Debug, Execute, Print

- Divide and conquer approach?

Problem: Write Algorithm and Flowchart to find solution of Quadratic equation

- **Algorithm**:
  - Step 1: Start
  - Step 2: Read a, b, c
  - Step 3: $d \leftarrow \text{sqrt}(\quad b \times b - 4 \times a \times c)$
  - Step 4: $x1 \leftarrow (-b + d) / (2 \times a)$
  - Step 5: $x2 \leftarrow (-b - d) / (2 \times a)$
  - Step 6: Print $x1$, $x2$
  - Step 7: Stop



Solving: $ax^2 + bx + c = 0$