# Problem Solving

# Advanced C
## Problem Solving – What?

- An approach which could be taken to reach to a solution

- The approach could be ad hoc or generic with a proper order

- Sometimes it requires a creative and out of the box thinking to reach to perfect solution

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## Problem Solving

- Introduction to SDLC

- Polya's Rules

- Algorithm Design Methods

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- Never jump to implementation. Why?
    - You might not have the clarity of the application
    - You might have some loose ends in the requirements
    - Complete picture of the application could be missing and many more...

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## Problem Solving - SDLC – A Quick Introduction

**Requirement**

**Design**

**Code**

**Test**

- Understand the requirement properly
- Consider all the possible cases like inputs and outputs
- Know the boundary conditions
- Get it verified

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## Problem Solving - SDLC – A Quick Introduction

**Requirement**

**Design**

**Code**

**Test**

- Have a proper design plan
- Use some algorithm for the requirement
  - Use paper and pen method
- Use a flow chart if required
- Make sure all the case are considered

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## Problem Solving - SDLC – A Quick Introduction

**Requirement**

**Design**

**Code**

**Test**

- Implement the code based on the derived algorithm
- Try to have modular structure where ever possible
- Practice neat implementation habits like
  - Indentation
  - Commenting
  - Good variable and function naming's
  - Neat file and function headers

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**Requirement**

**Design**

**Code**

**Test**

- Test the implementation thoroughly
- Capture all possible cases like
  - Negative and Positive case
- Have neat output presentation
- Let the output be as per the user requirement

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- Polya's rule

  - Understand the problem

  - Devise a plan

  - Carryout the Plan

  - Look back

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- A procedure or formula for solving a problem

- A sequence of unambiguous instructions for solving a problem, i.e., for obtaining a required output for any legitimate input in a finite amount of time.

- Algorithms is needed to generate correct output in finite time in a given constrained environment

  - Correctness of output

  - Finite time

  - Better Prediction

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## Problem Solving – Algorithm – How?

- Natural Language

- Pseudo Codes

- Flowcharts etc.,

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Problem Solving – Algorithm – Daily Life Example

- Let's consider a problem of reaching this room

- The different possible approach could be thought of

  - Take a Walk

  - Take a Bus

  - Take a Car

  - Let's Pool

- Lets discuss the above approaches in bit detail

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The steps could be like

1. Start a 8 AM

2. Walk through street X for 500 Mts

3. Take a left on main road and walk for 2 KM

4. Take a left again and walk 200 Mts to reach

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- Pros

    - You might say walking is a good exercise :)

    - Might have good time prediction

    - Save some penny

- Cons

    - Depends on where you stay (you would choose if you stay closer)

    - Should start early

    - Would get tired

    - Freshness would have gone

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Algorithm – Reaching this Room – Take a Bus

The steps could be like

1. Start a 8 .30 AM

2. Walk through street X for 500 Mts

3. Take a left on main road and walk for 100 Mts to bus stop

4. Take Bus No 111 and get down at stop X and walk for 100 Mts

5. Take a left again and walk 200 Mts to reach

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- Pros

  - You might save some time

  - Less tiredness comparatively

- Cons

  - Have to walk to the bus stop

  - Have to wait for the right bus (No prediction of time)

  - Might not be comfortable on rush hours

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The steps could be like

1. Start a 9 AM

2. Drive through street X for 500 Mts

3. Take a left on main road and drive 2 KM

4. Take a left again and drive 200 Mts to reach

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- Pros

  - Proper control of time and most comfortable

  - Less tiresome

- Cons

  - Could have issues on traffic congestions

  - Will be costly

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The steps could be like

1. Start a 8.45 AM

2. Walk through street X for 500 Mts

3. Reach the main road wait for you partner

4. Drive for 2 KM on the main road

5. Take a left again and drive 200 Mts to reach

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# Advanced C

- Pros

  - You might save some time

  - Less costly comparatively

- Cons

  - Have to wait for partner to reach

  - Could have issues on traffic congestions

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- All the above solution eventually will lead you to this room

- Every approach some pros and cons

- It would be our duty as a designer to take the best approach for the given problem

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## Algorithm – A Computer Example1

- Let's consider a problem of adding two numbers

- The steps involved :

    Start

    Read the value of A and B

    Add A and B and store in SUM

    Display SUM

    Stop

- The above 5 steps would eventually will give us the expected result

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- Let's consider a problem of adding two numbers

- The steps involved :

  BEGIN

  Read A, B

  SUM = A + B

  Print SUM

  END

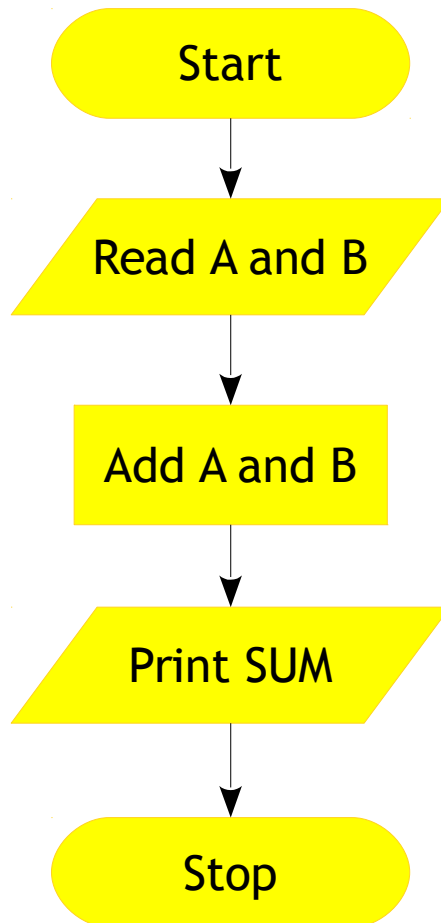- The above 5 steps would eventually will give us the expected result

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- Let's consider a problem of adding two numbers



```
      ┌──────────────┐
      │    Start      │
      └──────┬───────┘
             │
             ▼
      ╱──────────────╱
     ╱  Read A and B ╱
    ╱──────────────╱
             │
             ▼
      ┌──────────────┐
      │  Add A and B │
      └──────┬───────┘
             │
             ▼
      ╱──────────────╱
     ╱  Print SUM    ╱
    ╱──────────────╱
             │
             ▼
      ┌──────────────┐
      │    Stop       │
      └──────────────┘
```

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- Write an algorithm to print the below pattern

```
***********
*         *
*         *
*         *
*         *
*         *
*         *
***********
```

- Write an algorithm to print number pyramid

```
1234554321
1234__4321
123____321
12_____21
1_____1
```

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- Finding largest of 2 numbers

- Find the largest member of an array

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## Algorithm – Home Work

- Count the number of vowels

- Count the number of occurances of each vowel

- To find the sum of n – natural numbers

- Convert a number from base 10 to base N