

Problem Solving



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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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Problem Solving - SDLC - A Quick Introduction



- 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

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

Design

Code

Test

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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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Problem Solving - SDLC - A Quick Introduction



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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Problem Solving - How?

- Polya's rule
 - Understand the problem
 - Devise a plan
 - Carryout the Plan
 - Look back

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Problem Solving - Algorithm - What?



- 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.

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Problem Solving - Algorithm - Need?



- 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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Algorithm - Reaching this Room - Take a Walk



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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Algorithm - Reaching this Room - Take a Walk



- 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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Algorithm - Reaching this Room - Take a Bus



- 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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Algorithm - Reaching this Room - Take a Car



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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Algorithm - Reaching this Room - Take a Car



- Pros
 - Proper control of time and most comfortable
 - Less tiresome
- Cons
 - Could have issues on traffic congestions
 - Will be costly

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Algorithm - Reaching this Room - Let's Pool



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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Algorithm - Reaching this Room - Let's Pool



- 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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Algorithm - Daily Life Example - Conclusion



- 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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Algorithm - A Computer Example1 - Pseudo Code

- Let's consider a problem of adding two numbers
- The steps involved :

BEGIN

Read A, B

$SUM = A + B$

Print SUM

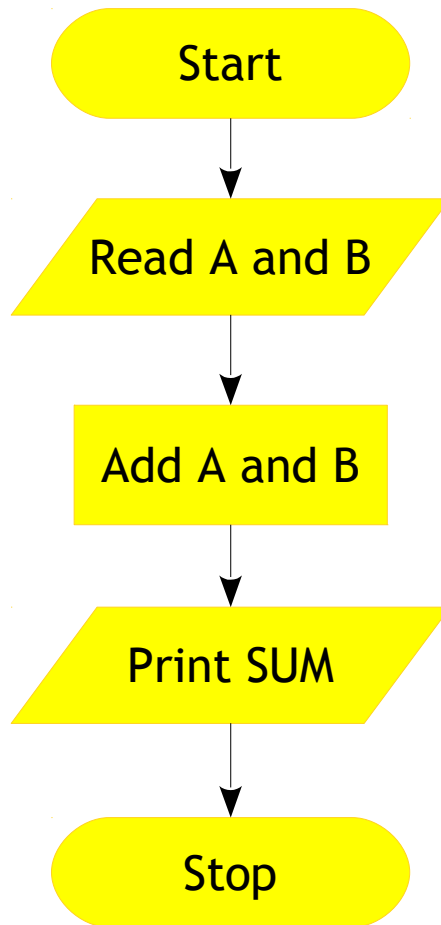
END

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

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Algorithm - A Computer Example1 - A Flow Chart

- Let's consider a problem of adding two numbers



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Algorithm - DIY - Pattern



- Write an algorithm to print the below pattern

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

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Algorithm - DIY - Pattern



- Write an algorithm to print number pyramid

```
1234554321
1234__4321
123____321
12_____21
1_______1
```

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Algorithm - DIY

- 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 occurrences of each vowel
- To find the sum of n - natural numbers
- Convert a number from base 10 to base N