Programming in C

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Programming Logic

Program Development Cycle

- A correct program can be written with proper planning and its implementation.
- Simple problems can be coded with ease but it is difficult to develop programs for complex problems.
- Programmer must master the complexity of the program with proper planning.
- A series of steps must be followed in the process of program development called as Program Development Cycle (PDC).
- Steps involved are:
  - Problem analysis
  - Design a solution
  - Program coding
  - Testing and debugging
  - Implementation and maintenance
  - Documentation

Program Development Cycle – Problem analysis

- Problem definition must be identified. It is important to have a clear and concise problem statement.
- Problem analysis is the process of eliciting (extracting/finding), documenting, analyzing, validating and monitoring the requirements.
- The problem definition should clearly specify the following tasks:

a) Objective
   - Problem should be stated clearly so that there will not be chance of having right solution to the wrong problem.
   - For complex problem, we need a complex analysis with careful coordination of people, procedure and program.

b) Output requirements
   - End users must actively participate to determine what should the system generate as output. They know the actual problem and need of the system.

Program Development Cycle – Problem analysis

c) Input requirements

- To obtain the expected output, it is required to define the input data and the source of the input data.

d) Processing requirements

- It is required to clearly define the requirements (hardware / software) to convert the input data to the required output.

e) Evaluating feasibility

- It is where we mainly decide whether the project is feasible or not.
- Availability of hardware, software, manpower, budget, timeline, deployable environment, affordability is checked.

❖Also, there should be proper documentation of above tasks of program analysis.

Program Development Cycle – Design a solution

- In this stage, programming concepts like algorithm and flowchart are used.
- Besides these, various diagrams like
  - Block Diagram,
  - Data Flow Diagram (DFD),
  - Entity Relationship Diagram (ERD),
  - Class Diagram (CD),
  - Sequence Diagram (SD),
  - System Sequence Diagram (SSD),
  - Use Case Diagram (UCD), etc. are used.
- Such concepts helps in understanding the requirements, shaping up the program, and program coding.

Program Development Cycle – Design a solution

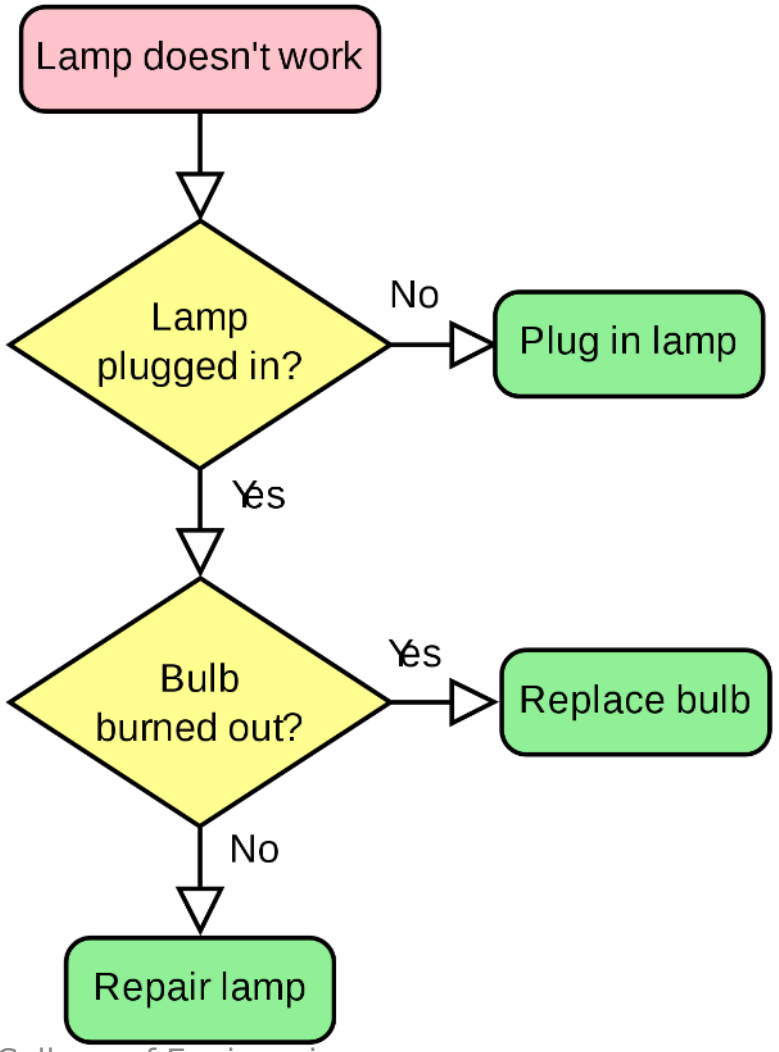
Algorithm

- It is a finite set of instructions written in a sequence that should be followed to solve a problem.
- Its characteristics are:
  - Input: one or more quantities are externally supplied for processing.
  - Output: after inputs are processed, it must produce at least one quantity as output.
  - Unambiguous: every instruction must be clear & should not produce confusing meaning.
  - Finiteness: algorithm should end after a finite number of steps.
  - Effectiveness: must be developed using basic operations so that it can be implemented effectively.

Program Development Cycle – Design a solution

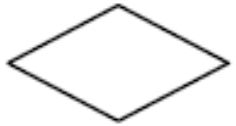
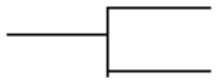
Flowchart

- It is a diagrammatic or pictorial illustration of the procedures for solving a given problem.
- It is also known as a graphical representation of algorithm.
- It consists of a set of symbols for different functions which help a programmer to solve a problem.



Program Development Cycle – Design a solution

Flowchart

Symbols	Name	Purposes
	Flow line	Used to connect symbols and indicate control flow.
	Terminal Box	Used to indicate the start and end of a flowchart
	Processing Box	Used for calculation or manipulation of data.
	Input / Output Box	Used for accepting data and displaying result.
	Decision Box	Used for checking conditions.
	Connector	Used to connect flowchart portion on the same page or another page.
	Commentator	Used to put comments

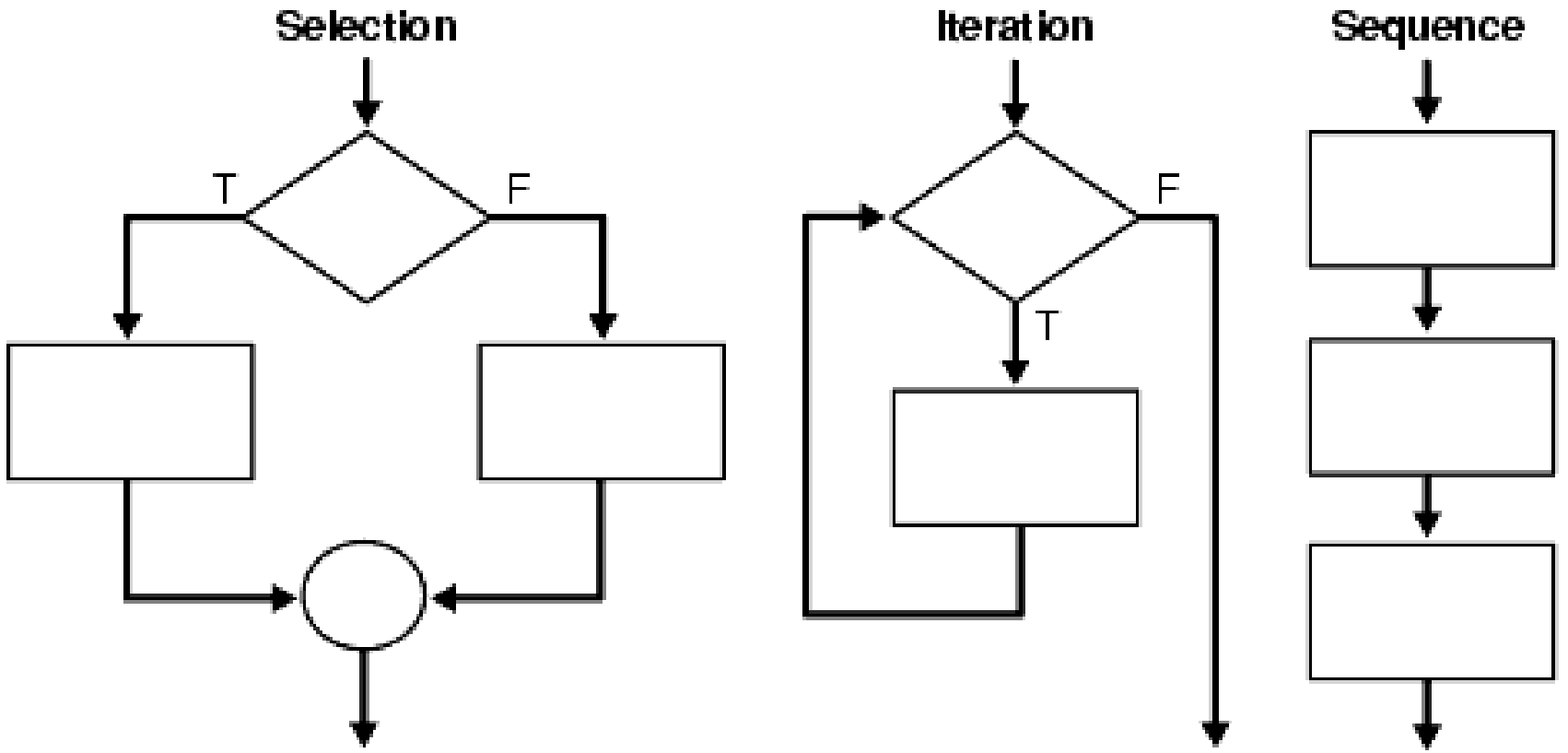
Program Development Cycle – Design a solution

Advantages of Flowchart:

- Provides a clear overview of the entire problem
- Serves as a guide for program coding
- A convenient method of communication
- An important tool for planning and designing a system
- Helps during error detection and removal
- Can be used for effective analysis of the problem
- Helps in efficient program maintenance.

Program Development Cycle – Design a solution

Structure of Flowchart:

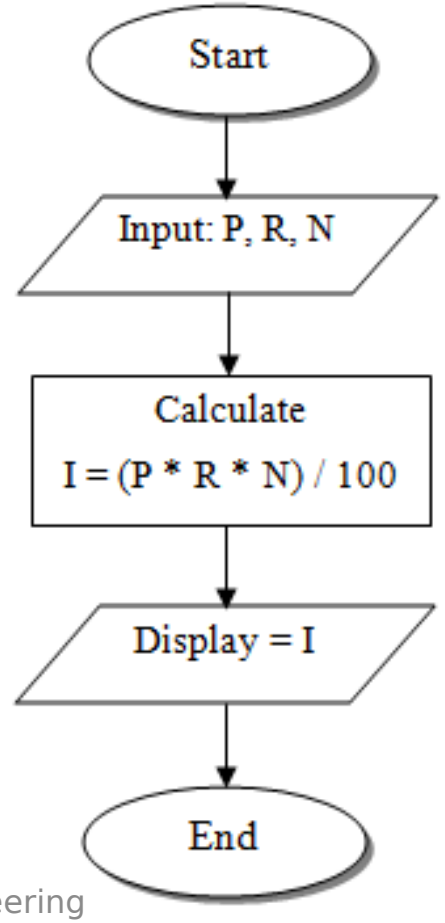


Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to find out the simple interest.

Algorithm:

1. Start
2. Take inputs Principal, Rate and No of years (i.e P,T,N)
3. Calculate interest (I)
4. Display Interest
5. Stop

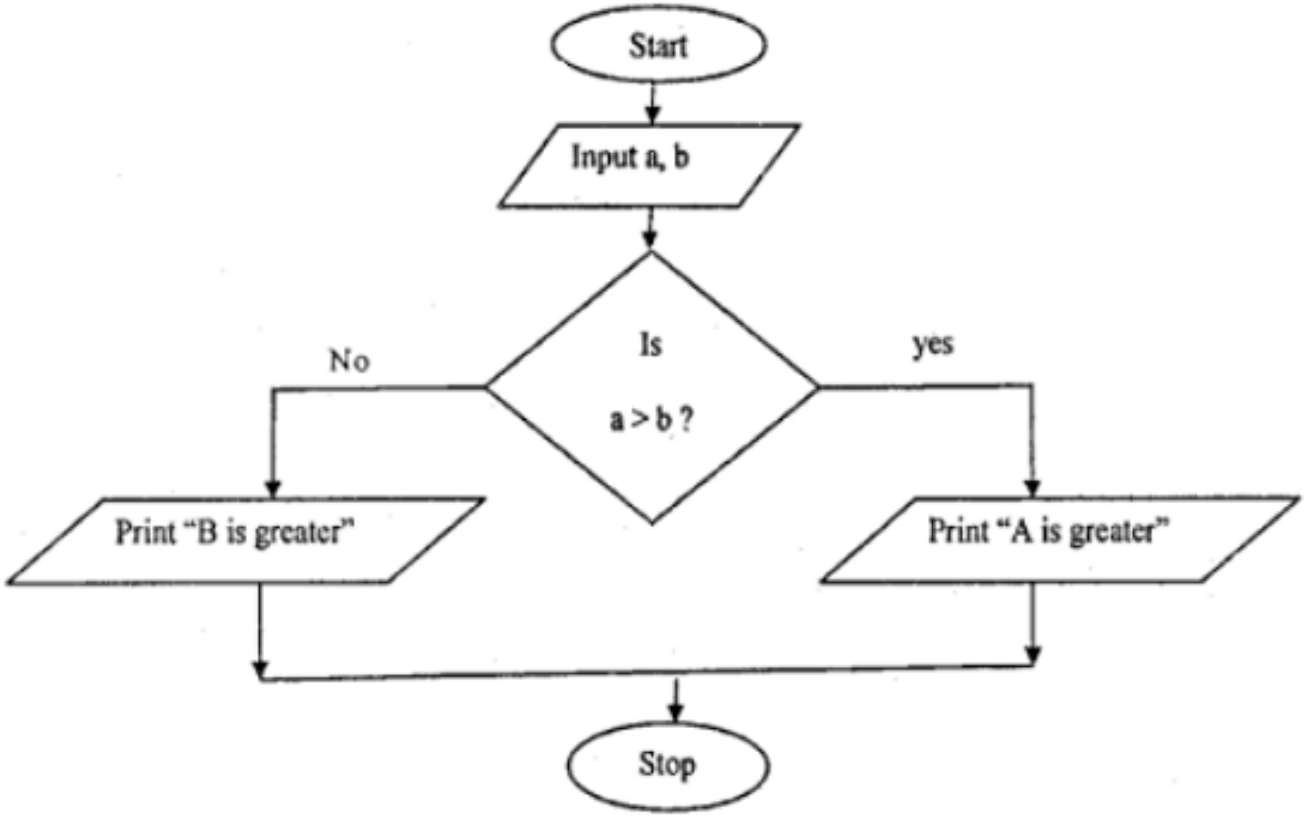


Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to find the largest among two numbers.

Algorithm:

1. Start
2. Input A and B
3. Check: Is A>B?
   Yes: Print "A is greatest"
   No: Print "B is greatest"
4. Stop



Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to find the number as positive,

Algorithm:

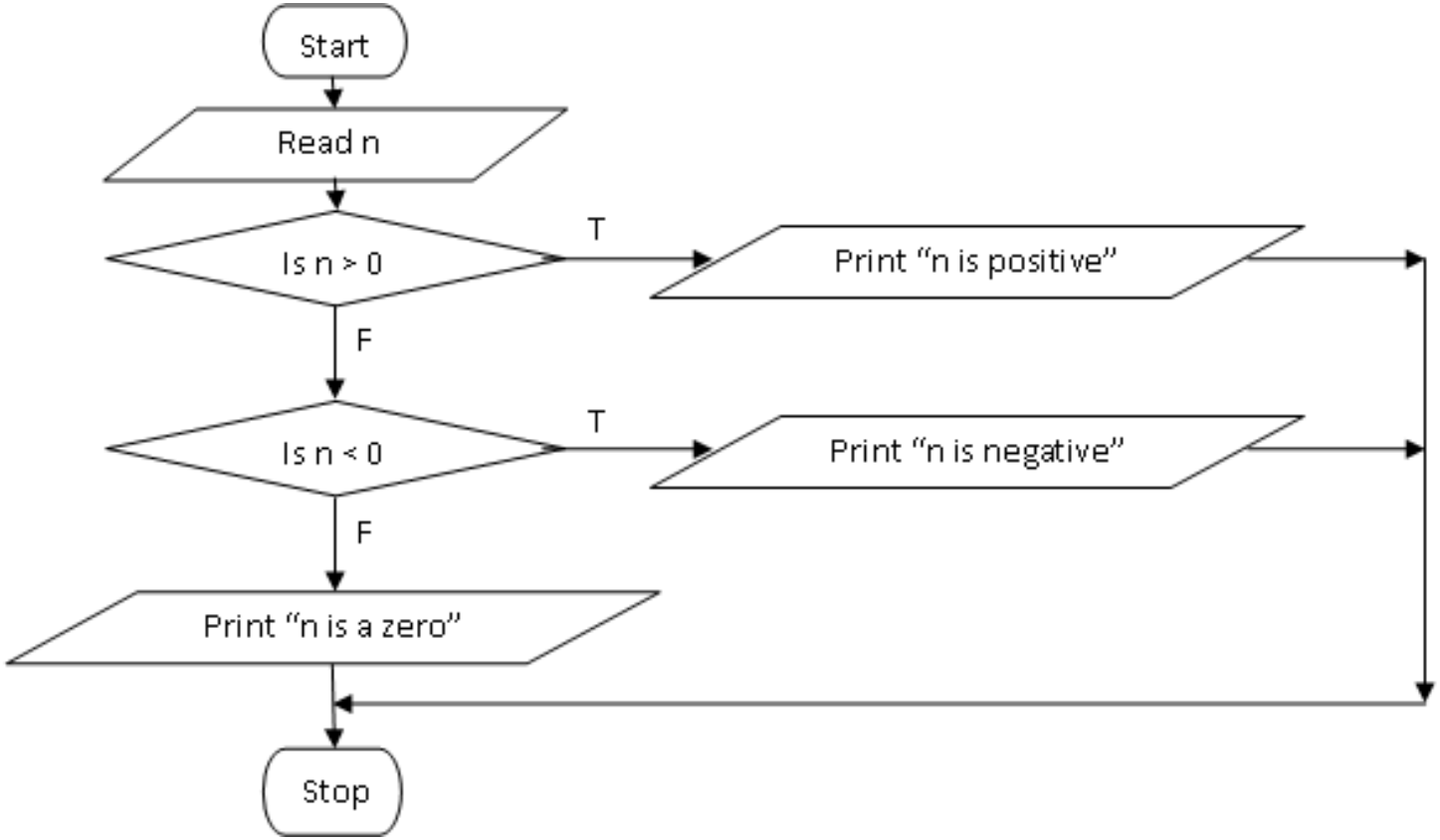
1. Start
2. Input N
3. Check: Is N>0?

   Yes: Print "N is positive" and go to step 5

   No: go to step 4
4. Check: Is N<0?

   Yes: Print "N is Negative" and go to step 5

   No: Print "N is a Zero" and go to step 5
5. End

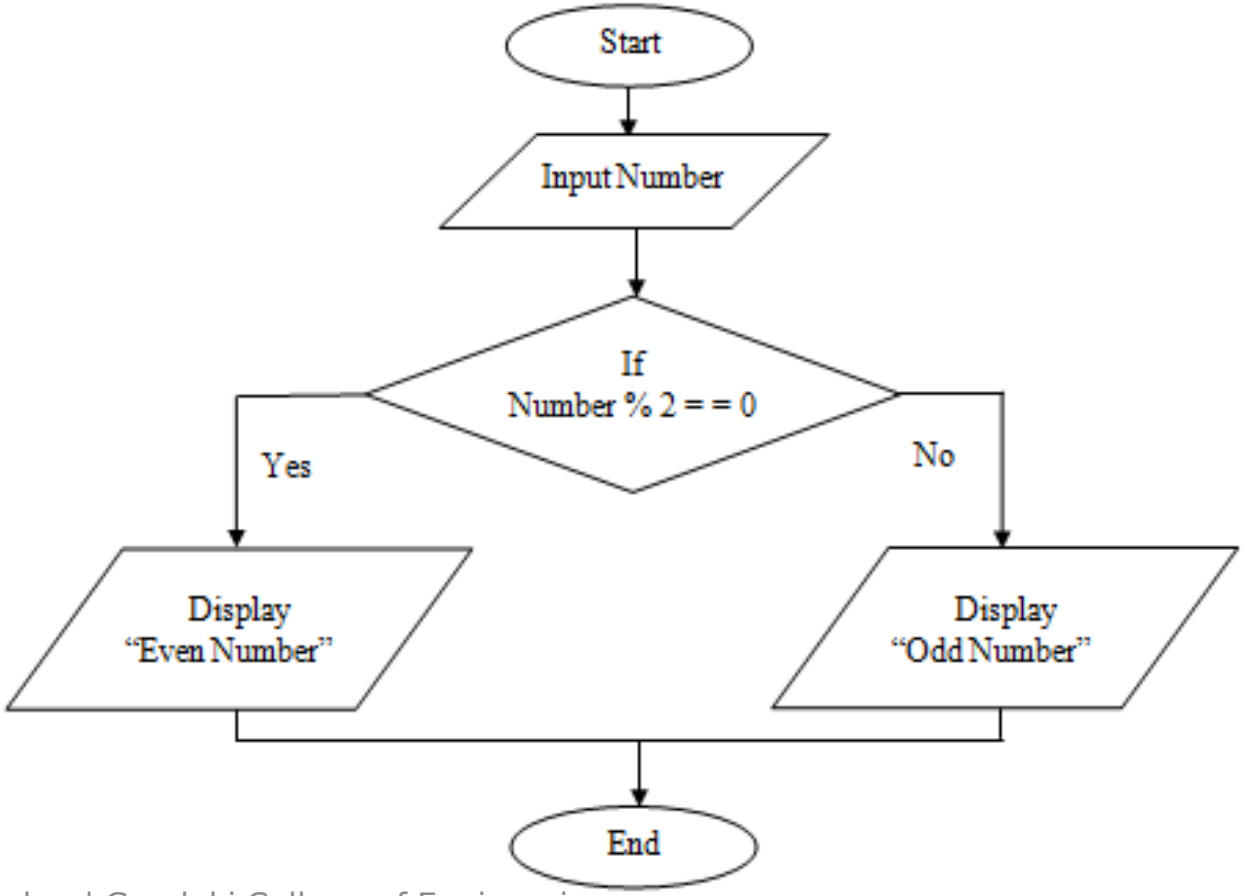


Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to find the number as odd or even.

Algorithm:

1. Start
2. Input N
3. Check: Is N%2==0?
   Yes: Print "EVEN"
   No : Print "ODD"
4. End

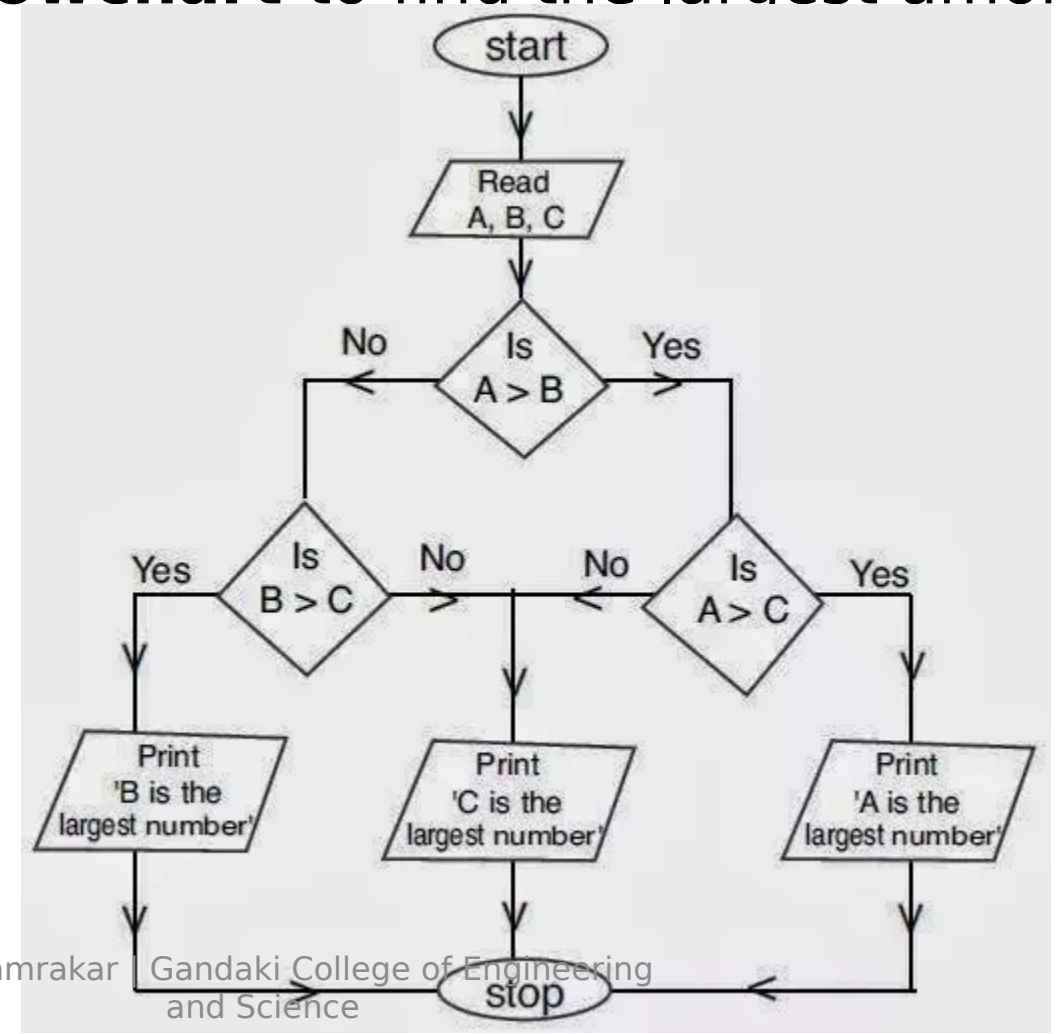


Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to find the largest among three

Algorithm:

1. Start
2. Input A,B,C
3. Check: Is A>B?
   Yes: go to step 4
   No : go to step 5
4. Check: Is A>C?
   Yes: Print " A greatest" and goto step 6
   No : Print "C greatest" and goto step 6
5. Check: Is B>C?
   Yes: Print " B greatest" and goto step 6
   No : Print "C greatest" and goto step 6
6. Stop

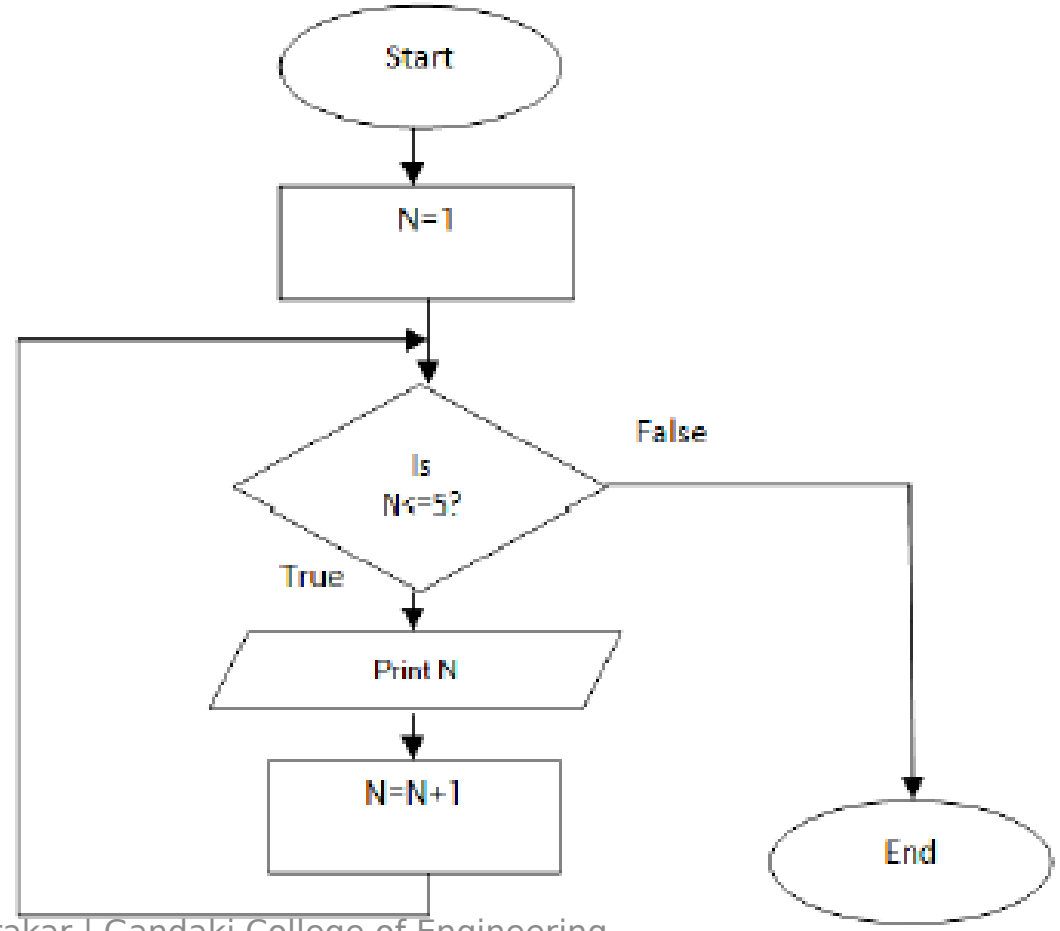


Program Development Cycle – Design a solution

Sample Algorithm & Flowchart to display the numbers from 1 to 5.

Algorithm:

1. Start
2. Initialize N=1
3. Check: Is N<=5?
   Yes: go to step 4
   No: go to step 6
4. Print N
5. N=N+1 and go to step 3
6. End



end

Program Development Cycle – Design a solution

Pseudocode

- It is an informal way of programming description that does not require any strict programming language syntax or underlying technology considerations.
- It is used for creating an outline or a rough draft of a program.
- It summarizes a program's flow but excludes underlying details.
- It is written (by system designers) to ensure that programmers understand requirements and align the code accordingly.
- It consists short phrases to explain specific tasks within a program. It should not include keywords.
- Indentation can be used to show the logical program flow in pseudocode also.

Program Development Cycle – Design a solution

Pseudocode

- It saves time during the coding and testing stage.
- It helps in communication between designers, coders and project managers.

1. To check if student passes or fails.

If student's grade is greater than or equal to 60

Print “passed”

else

Print “failed”

2. Calculate perimeter of rectangle.

Enter length, l

Enter width, w

Compute Perimeter = 2*l + 2*w

Display Perimeter of a rectangle

Program Development Cycle – Program coding

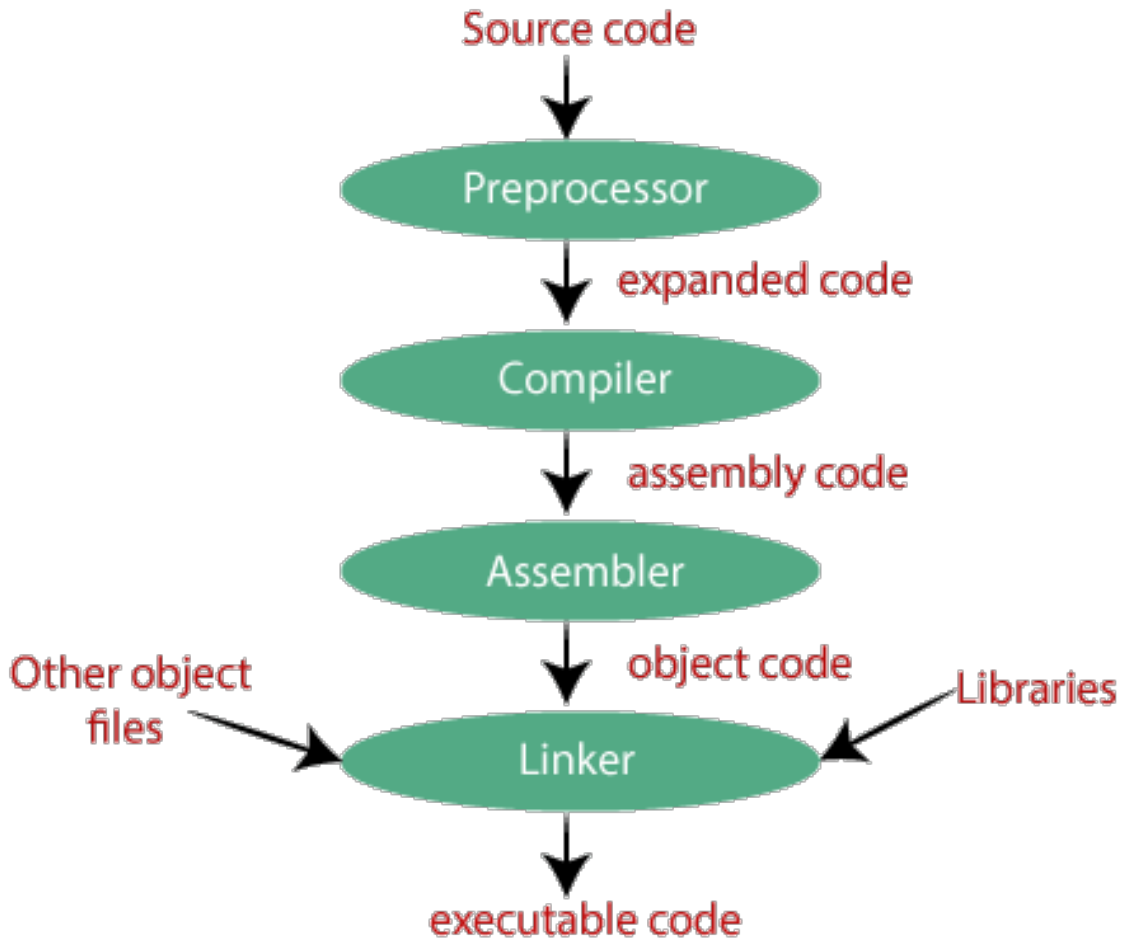
- The algorithm and flowchart cannot be read by the computers.
- It should be written in a programming language to develop a program.
- Coding can be done in HLL and LLL.
- An efficient program has features like easy, reusable, reliable, proper error handling, easy maintenance, support after installation, upgradable.

```c
// C gets function & scanf difference example

#include <stdio.h>

int main()
{
    char name[50];
    char n[50];
    char nm[50];

    printf("\n Please Enter your Full Name: \n");
    scanf("%s %s %s", name, n, nm);
    //gets(name);

    printf("\n=============\n");
    printf("%s \n", name);
    printf("%s \n", n);
    printf("%s", nm);

    return 0;
}
```

Program Development Cycle –

Compilation & Execution

- Program written in HLL needs to be converted into LLL, compiler does this task.
- Code that is ready to run is called executable code or machine code.



Program Development Cycle – Testing & Debugging

- It is the process of detecting and removing errors in the program.
- Debugging is the process of isolating and correcting any type of errors found.
- Testing is the process of executing a program with intent of finding error.
- Types of error:
  - Syntax error
  - Runtime error
  - Logical error
  - Compilation error
- Testing is usually performed for following purposes:
  - To improve quality
  - For verification and validation
  - For reliability estimation

Program Development Cycle –Implementation & Maintenance

- After the program is debugged and tested, the overall programs are integrated.
- Integration testing is done afterward to check if any errors generate due to integration.
- Final program is implemented in the client environment.
- At regular interval, program has to go for maintenance due to the change in technology, client request or other environmental factor.

Program Development Cycle – Documentation

- Documentation starts from the very beginning of the Software Development Life Cycle (SDLC).
- It keeps most of the information of all phases while developing projects.
- It is used for future reference for all sorts of manpower.
- It should contain information like:
  - Program analysis document or Software Requirement Specification (SRS).
  - Design documents including algorithm, flowcharts, appropriate diagrams.
  - Verification documents with details of testing and correction procedure, along with test data.
  - Program logs which is used to document future program revision and maintenance activity.

Assignment 2 – Due 30th May

1. Define flowchart, the role of flowchart in efficient program maintenance with its character. Write an algorithm and draw flowchart to generate Fibonacci sequence of eight terms.
2. Define algorithm. Write an algorithm and draw a flowchart to read 3 numbers from the user and find the smallest one.
3. Briefly write about:
   a) Software Development Life Cycle (SDLC)
   b) Pseudo code
   c) Documentation

Thank you