SNS COLLEGE OF ENGINEERING

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Department of Artificial Intelligence and Data Science

Course Name – Computational Thinking and Python Programming

I Year / I Semester

Unit 1-Computational thinking and problem solving

PROBLEM SOLVING

Problem solving is the systematic approach to define the problem and creating number of solutions. The problem solving process starts with the problem specifications and ends with a correct program.

PROBLEM SOLVING TECHNIQUES

Problem solving technique is a set of techniques that helps in providing logic for solving a problem. Problem solving can be expressed in the form of
1. Algorithms.
2. Flowcharts.
3. Pseudo codes.
4. Programs

ALGORITHM:

It is defined as a sequence of instructions that describe a method for solving a problem. In other words it is a step by step procedure for solving a problem
• Should be written in simple English
• Each and every instruction should be precise and unambiguous.
• Instructions in an algorithm should not be repeated infinitely.
• Algorithm should conclude after a finite number of steps. •
Should have an end point
• Derived results should be obtained only after the algorithm terminates.

Qualities of a good algorithm

The following are the primary factors that are often used to judge the quality of the algorithms.

Time – To execute a program, the computer system takes some amount of time. The lesser is the time required, the better is the algorithm.

Memory – To execute a program, computer system takes some amount of memory space. The lesser is the memory required, the better is the algorithm.

Accuracy – Multiple algorithms may provide suitable or correct solutions to a given problem, some of these may provide more accurate results than others, and such algorithms may be suitable

Building Blocks of Algorithm:

As algorithm is a part of the blue-print or plan for the computer program. An algorithm is constructed using following blocks.
• Statements
• States
• Control flow
• Function

Statements Statements are simple sentences written in algorithm for specific purpose.

Statements may consists of assignment statements, input/output statements, comment statements

Example:
• Read the value of 'a' //This is input statement
• Calculate c=a+b //This is assignment statement
• Print the value of c // This is output statement
        Comment statements are given after // symbol, which is used to tell the purpose of the line.

States :
        An algorithm is deterministic automation for accomplishing a goal which, given an initial state, will terminate in a defined end-state. An algorithm will definitely have start state and end state.

Control Flow:
        Control flow which is also stated as flow of control, determines what section of code is to run in program at a given time.
There are three types of flows, they are
1.Sequential control flow
2. Selection or Conditional control flow
3. Looping or repetition control flow

Sequential control flow:
The name suggests the sequential control structure is used to perform the action one after another. Only one step is executed once.
The logic is top to bottom approach.

Example
Description: To find the sum of two numbers.
1. Start
2. 2. Read the value of 'a'
3. 3. Read the value of 'b'
4. 4. Calculate sum=a+b
5. . Print the sum of two number
6. 6. Stop

Selection or Conditional control flow :
        Selection flow allows the program to make choice between two alternate paths based on condition. It is also called as decision structure Basic structure:

        IFCONDITION is TRUE then
            perform some action
        ELSE IF CONDITION is FALSE then
            perform some action

The conditional control flow is explained with the example of finding greatest of two numbers.

Example

Description: finding the greater number

1. Start
2. Read a 4
3. Read b
4. If a>b then
   4.1. Print a is greater
else
   4.2. Print b is greater
5. Stop

Repetition control flow:

      Repetition control flow means that one or more steps are performed repeatedly until some condition is reached. This logic is used for producing loops in program logic when one one more instructions may need to be executed several times or depending on condition.
      Basic Structure: Repeat untilCONDITIONis true Statements

Example :

Description: to print the values from 1 to n

1. Start
2. 2. Read the value of 'n'
3. Initialize i as 1
4. Repeat step
   4.1 until i< n
4.1. Print i
5. Stop

Function :

A function is a block of organized, reusable code that is used to perform a single, related action. Function is also named as methods, sub-routines.

Elements of functions:
1. Name for declaration of function
2. Body consisting local declaration and statements
3. Formal parameter
4. Optional result type.
   Basic Syntax function_name(parameters) function statements end function

Algorithm for addition of two numbers using function
Main function()
   Step 1: Start
   Step 2:Call the function add()
   Step 3: Stop
sub function add()
   Step1:Functionstart 5
   Step2:Geta,bValues
   Step 3: add c=a+b
   Step 4: Printc
   Step 5: Return