PROGRAM SOLVING AND PROGRAM PLANNING

Need for problem solving and planning a program

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Introduction Scenario

- Suppose you are asked by your mathematics teacher to solve an arithmetic problem and you are not familiar with the steps involved in solving that problem.

- *In such a situation, you will not be able to solve the problem.*

Introduction Scenario

- The same principle applies to writing the program. *A programmer cannot write instructions for computer unless the programmer knows how to solve the problem manually.*

- *Thus, to write an effective and efficient program, it is necessary that the programmer must write each and every instruction in the proper sequence. However, the sequence of instructions, referred to as Logic, of a program can be very complex.*

Problem Solving

- Therefore, it is very important that before attempting to write a program, the programmers must solve the problem manually.
- *While solving a problem, the programmer will be able to learn about the various steps to be performed and the sequence in which these steps are to be performed.*

Problem Solving

- To demonstrate how the programmer should proceed, let us consider a familiar example of finding the roots of a quadratic equation of type:

$$ax^2 + bx + c = 0 \qquad \text{provided } a \neq 0$$

- We hope that all of you are familiar with quadratic equation.

Problem Solving

- The roots of such an equation are given by the formula:

$$\text{Root}_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

where b^2-4ac is known as the discriminant.

- Depending on the sign of the discriminant, there are three mutually exclusive possibilities for the roots:

Problem Solving

- Case 1: If $b^2-4ac < 0$, then the roots are imaginary, and we can compute real part and imaginary part separately as:

Real part = $-\frac{b}{2a}$ and imaginary part = $\frac{\sqrt{-(b^2-4ac)}}{2a}$

- Once we know the real and imaginary part of the root, we can determine the actual roots as (real part ± *i* imaginary part).

Problem Solving

- Case 2: If $b^2-4ac = 0$, then the roots are real and equal, and is computed as:

root = $-\frac{b}{2a}$

Problem Solving

- Case 3: If $b^2-4ac > 0$, then the roots are real and distinct and are computed as:

root1 = $\frac{-b-\sqrt{b^2-4ac}}{2a}$ and root2 = $\frac{-b+\sqrt{b^2-4ac}}{2a}$

- Therefore, we will proceed as

Problem Solving

- For a given set of values of a, b and c, compute expression b^2-4ac. Now compare the computed value of b^2-4ac with zero.
- If it is less than zero, compute the roots as shown in Case 1{ Link }.
- If it is equal to zero, compute the roots as shown in Case 2 { Link }.
- And if it is greater than zero, compute the roots as shown in Case 3 { Link }.

Program Planning

- Planning is very important in every walk of life. Even for our routine kind of things, we have to plan.

- Planning should not be in the mind only, you must write it down, i.e., *you must document it*.

Program Planning

- Likewise, if you know the steps to be followed for solving a given problem but you have not documented them, you may forget to apply some of the steps or you may apply some of the steps in wrong sequence.

- *Obviously, you will get a wrong answer. Similarly, while writing a program, if the programmer leaves out some of the instructions or writes the instructions in wrong sequence, the computer will give a wrong answer.*

Program Planning

- Therefore, in order to write an efficient and effective program, it is necessary that the programmer must write each and every instruction in the proper sequence.

- However, the sequence of instructions, referred to as a logic, of a program can be very complex.

- Hence, in order to ensure that the program instructions are appropriate for the given problem and are in the correct sequence, programs must be planned before they are written.