Problem Analysis

Algorithm

Definition: An **algorithm** is a solution that solves a problem through a set of clearly defined steps. It involves the development of a set of instructions or rules.

Inputs and Outputs

Inputs

Definition: An **input** is any detail that can affect what we require for the output.

Specifying Inputs

Good input specifications must:

1. Include only the important data that can affect what we require for the output and exclude any irrelevant details.
2. State the range of valid or acceptable values for these inputs.

Example

Input
x: a positive whole number
y: a positive whole number

Outputs

Definition: An output is the result that the algorithm produces.

Specifying Outputs

Example

Output
The sum of x and y

Problem-Solving Techniques

Decomposition

Decomposition is a technique of breaking down a complex problem or process into smaller parts (sub-problems) such that each part is more manageable and easier to understand.

Two Approaches to Decomposition

1. Incremental approach:
    - Identify quantitative features of the input or output that are causing the problem to be too large to handle. Sometimes, the solution to a small version of the problem with one or more features reduced can be found and gradually extended to larger versions of the problem. Each gradual extension of the solution is a separate sub-problem.
2. Modular approach:
    - Solve simple examples of the problem manually and identify tasks that are of different natures. Usually, these tasks can be separated from each other to become distinct sub-problems. This usually results in sub-problems that are different from each other.

Generalisation

Generalisation is a technique of replacing two or more similar items with a single, more general item.

Pattern Recognition

Pattern recognition is the technique of identifying similarities among two or more items.