Abstract Data Types

**abstract**, adj. *having only intrinsic form with no attempt at pictorial representation or narrative content.*

**abstract**, v. *to draw out the essence of a matter or to separate the fundamentals from irrelevant materials which surround them.*

**Abstract data type**: A set of data values and associated operations that are precisely specified, independent of any particular implementation.

The data values and related operations are defined with mathematical precision. Therefore, we may reason about effects of the operations regardless of whether a program actually implements the data type or not.

An abstract data type may be viewed as a black box where data values and associated functions are prominently specified and internal details are hidden.

The concept of abstraction means:

a. We know what a data type can do.
b. How it is done is hidden.

In other words, abstraction is a generalization of operations, with unspecified implementation.

- View screen images as objects such as people, trees and mountains rather than as individual dots of color.
- Think in terms of sea beaches rather than grains of sand.
- Look at houses rather than bricks.

Closely associated with the concept of abstraction is that of modularity, which is a technique of subdividing a solution into certain units (called modules). Each unit focuses on one task at a time, without other distractions. Modularity keeps the complexity of a
large program manageable by systematically controlling the interaction of its components.

Modularity and abstraction complement each other. While modularity breaks a solution into modules, abstraction specifies each module clearly before one implements it in a programming language.

Each module in a solution begins as a box that states what it does but not how it does it. For example, if one part of a solution is to sort some data, one of the boxes will be a sorting algorithm, as shown in the figure below.

The other boxes will know that the sorting box sorts, but they will not know how the sorting is actually performed. In this way, various components of a solution are kept isolated from each other.