



RIZAL TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING ARCHITECTURE AND TECHNOLOGY

DATA STRUCTURE AND ALGORITHM



INTRODUCTION TO DATA STRUCTURE AND ALGORITHMS

- Data Structure
- Algorithm

Objectives:

- ❑ Introduce the concept of variables, data types, data structures, types of analysis, algorithms.
- ❑ Differentiate the following terms: data types, data structures, abstract data type.
- ❑ Define what an Algorithm is and describe the criteria for creating a good algorithm
- ❑ Identify the ways to represent algorithms

Let's define

a **type** is a set of values

a **data type** refer to the data that a variable can hold in a programming language.

Two Data Types –

- **Build-in Data Type** – which a language has built-in support [example: integer, Boolean, float, char]
- **Derived Data Type** – which are implementation independent [example: list, array, stack, queue]

***All programming language has a set of built-in data types.

Let's define

Data Definition defines a particular data with the following characteristics

- **Atomic** – definition should define a single concept
- **Traceable** – definition should be able to mapped to some data element (piece of information or record)
- **Accurate** – definition should be unambiguous
- **Clear and Concise** – definition should be understandable

Data Object represents an object having a data

Data Structure

- specialized format to store and organize data in a computer's memory or disk
- collection of variables, possibly of several different data types connected in various ways

Basic Operations –

- Traversing
- Searching
- Insertion
- Deletion
- Sorting
- Merging

Types of Data Structure –

- Array
- Linked List
- Stacks
- Trees
- Hash Tables

Data Structure: Primitive vs Aggregate

- All data structures can be classified as primitives or aggregates

Primitives

- The simplest kind of data structure stores single data items.

[example: a variable that stores a Boolean value or an integer]

Aggregates

- Many data structures are capable of storing multiple data items.

[example: an array can store multiple data items in its various slots, and an object can store multiple data items via its fields]

Abstract Data Type

- specification of a set of data and set of operations performed in a data
- storage for data defined in terms of set of operations to be performed on the data

*** A data type is said to be an abstract when it is independent of various concrete implementation

The following **Abstract Data Types** implemented in a programming language include:

- Deque
- List
- Priority queue
- Set
- Stack
- Tree

Algorithm

- a step-by-step procedure, which defines a set of instructions to be executed in certain order to get the desired output.
- recipe for solving a problem

From the data structure point of view, following are some important categories of algorithms -

- Search
- Sort
- Insert
- Update
- Delete



Characteristics of an Algorithm

- not all procedures can be called an algorithm.

An algorithm should have the following characteristics –

- **Unambiguous** - Each of its steps (or phases), and their inputs/outputs should be clear and must lead to only one meaning.
- **Input** - An algorithm should have 0 or more well-defined inputs.
- **Output** – An algorithm should have 1 or more well-defined outputs, and should match the desired output.
- **Finiteness** – Algorithms must terminate after a finite number of steps.
- **Feasibility** – Should be feasible with the available resources.
- **Independent** – An algorithm should have step-by-step directions, which should be independent of any programming code.



Examples: Algorithm

Simple Algorithm: Applying Shampoo

- Apply to wet hair
- Massage gently
- Leave on for a few moments
- Rinse off

Simple Algorithm: Washing Dishes

- Stack dishes by sink
- Fill sink with soapy water
- While there are more dishes
 - get dish from counter
 - wash dish
 - push dish in drain rack
- Wipe off counter
- Rinse out sink



Examples: Algorithm

Problem: Design an algorithm to add two numbers and display the result

Step 1: START

Step 2: declare three integers a, b, and c

Step 3: define values of a and b

Step 4: add values of a and b

Step 5: store value of step 4 to c

Step 6: print c

Step 7: END

Alternatively,

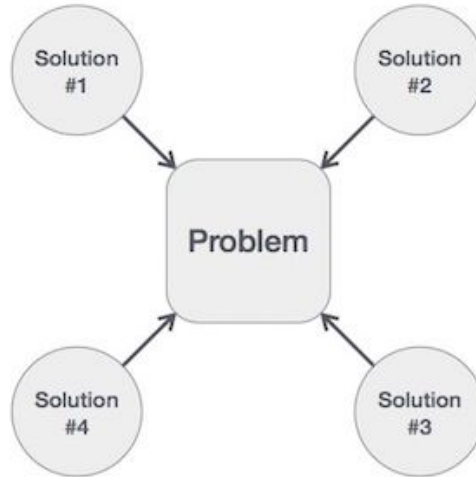
Step 1: START ADD

Step 2: get values of a and b

Step 3: $c \leftarrow a + b$

Step 4: display c

Step 5: STOP





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Thank You 😊
Keep safe
and God bless!

