INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS

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Contents

Introduction

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Concept 1

A **data structure** is a way to store and organize data in order to facilitate access and modifications.

- It is important to choose an appropriate data structure for a problem, because each data structure has its own advantages and disadvantages.

Concept 2

An **algorithm** is any well-defined computational procedure that takes some value, or set of values, as **input** and produces some value, or set of values, as **output**.

- The crucial question is: which algorithms are efficient in the chosen data structure?

C++ Data Type

Data Type

Concept 3

Data type $T = \langle V, O \rangle$

- V is a set of values
- O is a set of operations or methods

Consider `short int` T

- $V =$ `{-32768,...,32767}`
- $O =$ `{+,-,*,/}`

C++ Data Type

- Primitive data type

data type	size	operations
`bool`	1	...
`char, unsigned char`	1	...
`short, unsigned short`	2	...
`int, unsigned int`	4	...
`long, unsigned long`	4	...
`long long, unsigned long long`	8	...
`float`	4	...
`double`	8	...

C++ Data Type (cont.)

- Structured data type
  - `string`
  - `struct`
  - `class`
  - array

Abstract Data Type

Abstract Data Type

Concept 4

- An **abstract data type** (ADT) is a specification for a group of values and the operations on those values.
- A data structure is an implementation of an ADT within a programming language.

A `Stack` is an iterable collection of items that is based on the last-in-first-out (LIFO) policy

method	**description**
`push`	add an item to the stack
`pop`	remove the most recently added item

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