

CSc 3102:Preliminaries

Introduction

- What is Computer Science?
- Data Structure
- Algorithm
- Pseudocode Convention

What is Computer Science?

The early origins of *Computer science* as an academic discipline is rooted in the fields of applied mathematics and logic, and initially it was not thought of as a new discipline. You will observe that many of the principles in those fields are integrated into the study of computer science. Computer science is not about the study of computers, nor is it the study of programming. Programming is one of many tools that are used in computer science to explore new ideas and solutions to problems. Computer science is primarily about the study of algorithms, which includes their mathematical properties, their hardware and linguistic realizations, and their applications.

Data Structure

A *data structure* is a systematic way of organizing data that makes it easily accessible. In this course, we will organize the data structures using objects that store data, usually a homogeneous collection of identically typed items, and will provide operations (methods) that manipulate the collection.

Algorithm

An *algorithm* is a step-by-step procedure for performing some task in a finite amount of time. The following properties are common to any algorithm:

- *Input.* An algorithm has input values from a well-defined set.
- *Output.* From each set of input values an algorithm produces output values from a specified set. The output values are the solution to the problem.
- *Definiteness.* The steps of an algorithm must be defined precisely.
- *Correctness.* An algorithm should produce the correct output values for each set of input values.
- *Finiteness.* An algorithm should produce the desired output after a finite (but perhaps large) number of steps for any input in the set.
- *Effectiveness.* It must be possible to perform each step of an algorithm exactly and in a finite amount of time.
- *Scalability.* The procedure should be applicable for all problems of the desired form, not just for a particular set of input values.

Definition 1. The **analysis of algorithms** is the area of computer science that provides tools for contrasting the efficiency of different algorithms by how much space (storage/memory) they use or time they take to run.

Pseudocode

In order to specify the algorithms we will study in this course, we will use pseudocode. There is no precise definition of pseudocode but we may think of it as a mixture of a natural language, in our case English, and some high-level computer programming language. We will use the following conventions when specifying high-level programming constructs:

- **Expressions:** the usual mathematical symbols will be used in numeric and boolean expressions with some minor differences. \leftarrow will be used for assignment and $=$ will be used for testing for equality.

- **Method/Function Declarations:** **Algorithm** name(param1, param2,...) will be used in the declaration.
- **Decision Structures:** **if** condition **then** true-action [**else** false-action]. Indentation will be used for the actions.
- **Iteration structures:** **while** condition **do** actions, **repeat** actions **until** condition, **for** variable-increment-definition **do** actions will be used for pretest, post-test and count-controlled loops respectively. Indentation will also be use for the actions.
- **Array indexing:** $A[i]$ denotes the i^{th} cell of the array. We will use zero-based indexing.
- **Comments:** Comments will be written between a pair of braces, { *comments* }.