**Book Name:** Introduction to Algorithms(3rd edition)

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**Chapter 1: The Role of Algorithms in Computing**

The very first chapter of the book focuses on giving an overview of algorithms. It explains what algorithms are, what role it plays in computing that makes it worthwhile to study it and how it is connected to other technologies.

**Algorithms:**

An algorithm is a sequence of computational steps that operates on input/s and produces output or set of outputs. We can also view it as a medium or tool created to solve specific computational problems. A fine example of algorithm would be the sorting algorithms.

**Application of Algorithms:**

Application refers to those sectors in which algorithms are used. Some important sectors would be:

* Sorting
* Manipulation of huge amount of data
* Data analysis
* Cryptography
* Commercial enterprise
* Number theory
* Finding the best/optimal route
* Design & mapping etc.

The list would never end. However, many algorithms tend to show two characteristics.

1. There may be many candidate solutions and finding the one that is ‘best’ among them can be quite challenging.
2. They have practical applications.

**Data Structures:**

A data structure is a way to preserve and organize data in order to facilitate access and modifications. Different types of data structures might be suitable for different purposes. So, it is essential to gain knowledge regarding their strengths and limitations.

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**Chapter 2: Getting Started**

This chapter gives an idea of how the task is done, that is, how algorithms are constructed, how it works, its specialized structure, how to find if it is the ‘best’ one or not. It not only provides the techniques of algorithm design but also the procedures of analysis to understand their efficiency better.

The chapter starts with the construction of the ‘*Insertion Sort’* algorithm shortly followed by an explanation that describes how the algorithm works. Afterwards, analysis of algorithms is introduced accompanied by the analysis of Insertion Sort. As the chapter delves more, another technique *‘Merge Sort’* is introduced along with its runtime analysis.

**Runtime:**

The running time of an algorithm on a particular input is the number of primitive operations or steps executed. In simple words, runtime refers to the time the algorithm takes to execute and get the work done.

**Chapter 3: Growth of Functions**

The main focus if this chapter is the order of growth of the running time of an algorithm. In order to make the running time of large inputs relevant, the study of asymptotic efficiency of algorithms is very important. Usually, an algorithm that is asymptotically more efficient, will be the best choice for almost all the inputs unless it is very small.

**Asymptotic Notation:**

Asymptotic analysis of an algorithm refers to computing the running time of any operation in mathematical units of computation. Different notations are used to define different asymptotic analysis.

**Θ-notation:**

The Θ-notation asymptotically bounds a function from both above and below. To define a specific upper bound and lower bound, this notation is used.

**Ο-notation:**

The Ο-notation provides the upper bound of a function within a constant factor.

**Ω-notation:**

It provides the asymptotic lower bound of a function.

**O-notation:**

The asymptotic notation given by the O-notation may or may not be asymptotically right. The o-notation is used when it is not asymptotically tight.

ω**-notation:**

The ω-notation is used when the lower bound of a function is not asymptotically tight.