

Core Code Concepts

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# Document Purpose

The purpose of this document is to provide a basic Computer Science study guide to people who are taking introductory programming courses, studying for basic coding tests, or planning to obtain a software certification. You may be interested in this study guide if you are:

* Taking a Computer Science AP Course
* Studying for the Computer Science AP Test
* Registering for an Introductory Programming College Course
* Brushing up on Concepts for the Major Field Test in Computer Science
* Refreshing Core Skills for a Computer Science Certification Exam

## What this Guide Will Do

This guide will provide you with an overview of all the core competencies needed to be a well-rounded Computer Scientist. The following is a breakdown of the entire guide:

1. [The Core Concept Checklist](#_The_Core_Concept)
2. [Topic Breakdowns](#_Topic_Breakdowns)
3. [Nomenclature](#_Nomenclature)

The purpose of the Core Concept Checklist is to give you a way to keep track of all the concepts you’ve studied. Each topic is covered in the Topic Breakdown section. In order to keep the Topic Breakdown section light, definitions have been placed in a separate Nomenclature section.

## What this Guide Will **NOT** Do

This guide will not go into a deep dive of any of the subjects described. Likewise, none of topics will be covered using a specific language. Topics may reference a language, but this guide is purely conceptual and theoretical.

That said, I wouldn’t want to leave you hanging. That’s why I have a [website](https://therenegadecoder.com/) loaded with topics that go much further in depth than this document. If you visit, you should be able to find an explanation of just about every topic described in this document. If not, I’ve listed a few of my favorite go-to resources below:

* [CodeAcademy](https://www.codecademy.com/)
* [Computerphile](https://www.youtube.com/user/Computerphile)
* [Khan Academy](https://www.khanacademy.org/)
* [MIT OpenCourseWare](http://ocw.mit.edu/courses/#electrical-engineering-and-computer-science)
* [StackOverflow](https://stackoverflow.com/)

# The Core Concept Checklist

The purpose of this section is to provide you with a way of measuring your progress as you study through the material. As you get comfortable with a particular topic, you can mark it as complete here.

* [Algorithms](#_Algorithms)
* Artificial Intelligence
* Computer Architecture
* Computer Graphics
* Computer Networks
* Computer Security
* Database Systems
* Data Structures
* Digital Systems Design
* Discrete Math
* Distributed Computing
* Embedded Systems
* Game Development
* Human-Computer Interaction
* Modeling & Simulation
* Object Oriented Programming
* Operating Systems
* Programming Languages
* Robotics
* Software Engineering

# Topic Breakdowns

The purpose of this section is to provide an overview of each topic with a list of subtopics to explore.

## Algorithms

Algorithms are problem solving techniques which are used by every facet of Computer Science. These techniques are characterized by the methods they use to solve generic types of problems. If you’re looking to study algorithms, a good place to start would be to get familiar with the following types of problems:

* Combinatorial Algorithms
* Computational Math & Science Algorithms
* Computer Science Algorithms
* Signal Processing Algorithms

In addition, it’s probably a good idea to really dig deep into the following famous algorithms:

* Breadth & Depth First Search Algorithms
* Data Compression Algorithms
* Dijkstra’s Algorithm
* Integer Factorization Algorithm
* Map-Reduce Algorithm
* Merge Sort & Quick Sort Algorithm
* Random Number Generation Algorithms
* RSA Algorithm

Rather than studying algorithms directly, you can study algorithm fundamentals. The following topics are great if you want to get a better understanding of general algorithm design and analysis:

* Asymptotic Notation
* Divide and Conquer
* Dynamic Programming
* Loop Invariants
* Recurrence Relations

## Artificial Intelligence

## Computer Architecture

## Computer Graphics

## Computer Networks

## Computer Security

## Database Systems

## Data Structures

## Digital Systems Design

## Discrete Math

## Distributed Computing

## Embedded Systems

## Game Development

## Human-Computer Interaction

## Modeling & Simulation

## Object Oriented Programming

## Operating Systems

## Programming Languages

Programming languages are an area of Computer Science which defines the way we interface with computer hardware.

## Robotics

## Software Engineering

# Nomenclature

The purpose of this section is to provide you with a focused list of all the terms you’ll need to understand if you’re studying Computer Science or a related field.

**Algorithm**: a set of instructions for solving a problem

**Application Program Interface (API)**: a collection of exposed interfaces and protocols for the purpose of general reuse

**Concatenation**: the process of combining things together like a pair of strings or several lists

**Constant**: a value that is fixed and cannot be changed

**Comment**: an annotation of a line or section of code

**Compiler**: a software system which converts code to lower-level code

**Documentation**: literature that provides details about a library or tool

**Function**: a set of instructions that can be referenced by a name

**Graphical User Interface**: an interface which allows the use of electronic devices via graphical icons and visual cues

**Integrated Development Environment (IDE)**: a source code editor with automation tools

**Interpreter**: a software system which converts code to lower-level code on-the-fly

**Library**: a collection of implementations for the purpose of general reuse

**Loop**: a repeated sequence of instructions until some condition is met

**Method**: a function that is associated with an object

**Method Overloading**: the ability to define multiple functions in the same scope with the same name

**Method Overriding**: the ability of a subclass to create a more specific version of a method already provided by its superclass

**Multithreading**: the ability of a processor to execute multiple sets of instructions concurrently while sharing the same resources

**Polymorphism**: the ability of a variable, method, or object to exist in multiple forms

**Pseudo Code**: an informal or simplified programming language used to describe how a program should execute

**Readability**: the measure of ease of interpretation and understanding of source code

**Recursion**: a method of problem solving which derives the solution from solutions to smaller sections of the same problem

**Variable**: a value that is subject to change

**Version Control**: a system that supports organization of many versions of software