

# C Programming Guide

From Beginners to Intermediate Learners

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## 1. Introduction to C Language

- History and origin
- Features and uses of C
- Where C is used (OS, embedded, compilers, etc.)

## 2. Basic Syntax & Structure

- Structure of a C program
- Header files and main function
- Compilation and execution process

## 3. Variables and Data Types

- int, float, char, double, void
- Declaring and initializing variables
- Constants and macros

## 4. Operators in C

- Arithmetic, Relational, Logical, Bitwise
- Assignment and Conditional (ternary)

## 5. Control Flow Statements

- if, else, nested if
- switch case
- Loops: for, while, do-while
- break, continue, goto

## 6. Functions in C

- Function declaration and definition
- Parameters return types
- Recursion
- Inline functions

## 7. Arrays and Strings

- 1D and 2D Arrays
- Character arrays and strings
- String handling functions (strlen, strcpy, etc.)

## 8. Pointers in C

- Pointer basics and syntax
- Pointers with arrays, functions, and strings
- Pointer arithmetic
- NULL and wild pointers

## 9. Structures and Unions

- Defining and using structures
- Nested structures
- Difference between structure and union

## 10. File Handling in C

- Reading and writing to files
- File pointers (fopen, fread, fwrite, fclose)
- Modes of file access (r, w, a, etc.)

## 11. Memory Management

- malloc, calloc, realloc, free
- Stack vs Heap memory

## 12. Preprocessor Directives

- #define, #include, #ifdef, #ifndef
- Macros and conditional compilation

## 13. Practice Examples & Mini Projects

- Calculator
- File reader/writer
- Student record system
- Matrix operations

## 14. Cheat Sheet Section

- Common syntax quick reference
- List of most-used stdlib functions

## 15. Resources

- Books: “Let Us C”, “The C Programming Language”
- Online: GeeksforGeeks, W3Schools, TutorialsPoint, Programiz
- GitHub links (free projects and notes)