

Complete Roadmap for C Programming with Project.

-SolitaryHorkos

Stage 1: Basics of C Programming

Duration: 2-4 weeks

Topics to Cover:

1. Introduction to C

- History and significance of C
- Setting up the development environment (VS Code, MinGW)
- Writing and running the first C program (Hello, World!)

2. Basic Syntax

- Structure of a C program
- Data types (int, float, char, double, etc.)
- Variables: declaration, initialization, assignment
- Constants and literals
- Type conversion and typecasting

3. Operators

- Arithmetic (+, -, *, /, %)
- Relational (<, >, <=, >=, ==, !=)
- Logical (&&, ||, !)
- Bitwise (&, |, ^, ~, <<, >>)
- Assignment and miscellaneous operators

4. Control Structures

- If-else statements

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- Switch-case statements
- Loops (for, while, do-while)
- Break and continue statements

5. Functions

- Function declaration, definition, and calling
- Function prototypes
- Scope and lifetime of variables
- Recursion

Practice:

- Solve simple math problems (calculate area, volume)
- Implement pattern printing programs (pyramids, stars, etc.)

Project Idea:

- **Mini Calculator:** A command-line calculator that supports basic operations (+, -, *, /).

Stage 2: Intermediate Concepts

Duration: 3-5 weeks

Topics to Cover:

1. Arrays

- One-dimensional and Multi-dimensional arrays
- Common operations: traversing, searching, sorting

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2. Strings

- Character arrays
- String manipulation functions (strlen(), strcpy(), strcat(), strcmp())

3. Pointers

- Pointer basics (declaration, initialization, dereferencing)
- Pointer arithmetic
- Pointers and arrays
- Pointer to pointer (double pointers)

4. Structures and Unions

- Defining and using structures
- Arrays of structures
- Understanding unions and memory management

5. File Handling

- Opening and closing files
- Reading from and writing to files
- File handling functions (fopen, fclose, fread, fwrite)

Practice:

- Write programs for array and string manipulation
- Implement searching (linear, binary) and sorting algorithms (bubble, selection, insertion)

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Project Idea:

- **Library Management System:** A system to manage book details, including adding, searching, and deleting records.
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Stage 3: Advanced Concepts

Duration: 4-6 weeks

Topics to Cover:

1. Dynamic Memory Allocation

- malloc(), calloc(), realloc(), free()
- Memory leaks and best practices

2. Advanced Data Structures

- Linked lists (singly, doubly, circular)
- Stacks and queues
- Trees (binary trees, binary search trees)

3. Algorithms

- Sorting algorithms (quicksort, mergesort)
- Searching algorithms (binary search)

4. Preprocessor Directives

- Macros and header files
- Conditional compilation (#ifdef, #ifndef, #endif)

5. Error Handling

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- `errno`, `perror()`, `assert()`

Practice:

- Work with linked lists, stacks, and queues
- Read and write structured data using files

Project Idea:

- **Employee Management System:** A program that handles employee records, including adding, updating, searching, and deleting records.

Stage 4: Mastery and Real-World Applications

Duration: 4-8 weeks

Topics to Cover:

1. **Preprocessor Directives and Macros**
2. **Bit Manipulation**
 - Working with bits and bytes
 - Implementing bitwise algorithms
3. **System Programming Basics**
 - Working with processes
 - Interfacing with hardware
4. **Networking Basics**
 - Sockets and client-server programming

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5. Optimizations

- Writing efficient C code
- Memory management best practices

Practice:

- Solving competitive programming problems
- Optimize code for performance and memory usage

Projects:

- **Text Editor:** A basic text editor with features like creating, editing, and saving files.
- **Snake Game:** A console-based snake game.
- **Simple Compiler:** A mini compiler that can process a subset of C code.

Final Steps

What to Do:

- **Build a Portfolio:** Showcase your projects on GitHub
- **Contribute to Open Source:** Engage in C projects on GitHub
- **Explore Real-World Applications:** Embedded systems, OS development, game programming

Advanced Projects:

- **Simple Shell:** A basic shell interface that takes commands as input and executes them

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- **HTTP Server:** A basic server that serves static HTML files
- **Tetris Game:** A terminal-based Tetris game