INTERMEDIATE C PROGRAMMING

COURSE OVERVIEW

This course continues the students' study of the C programming language using the C99 standard. The core C language features covered in this course include functions, arrays, strings, pointers, dynamic memory allocation, library functions, structures, and file I/O. Programming techniques covered by this course include modularity, top-down design, documentation, debugging, and testing.

WHO WILL BENEFIT FROM THIS COURSE?

This course is for programmers who have had experience in any programming language or have been tasked with a C programming project, and other technical types including managers and customer support engineers who need to know C.

PREREQUISITES

Students should have completed our 'Introduction to C Programming' course or have equivalent knowledge of the C programming language.

COURSE OBJECTIVES

Upon completion of this course, students will be able to:

- Write C programs that are non-trivial.
- Use the variety of data types appropriate to specific programming problems.
- Utilize the modular features of the language.
- Demonstrate efficiency and readability.
- Demonstrate the use of the various control flow constructs.
- Use arrays as part of the software solution.
- Utilize pointers to efficiently solve problems.
- Include the structure data type as part of the solution.
- Create their own data types. Use functions from the portable C library.

COURSE OUTLINE

Chapter 1: Getting Started

- What is C?
- Background
- Sample Program
- Components of a C Program
- Examples
- Data Types
- Variables

- Naming Conventions for C Variables
- Printing and Initializing Variables
- Array Examples
- Compiling and Executing a C Program

Chapter 2: Functions and Operators

- Functions
- Invoking Functions
- Elementary Operators
- The Assignment Operators
- Number of Operands
- The Conditional Operator
- Increment and Decrement Operators

Chapter 3: Control Flow Constructs

- Examples of Expressions
- Endless Loops

Chapter 4: The C Preprocessor

- Preprocessor Macros
- Conditional Compilation

Chapter 5: Simple I/O

- Character I/O
- End of File
- Simple I/O Examples
- Simple I/O Redirection
- I/O with Character Arrays

Chapter 6: More on Functions

- Introduction
- Function Declarations
- Returning a Value or Not
- Function Prototypes
- Arguments and Parameters
- Organization of C Source Files

- Extended Example
- The getaline Function
- The strcmp Function
- The check Function
- The atoi Function
- The average Function
- Summary

Chapter 7: Bit Manipulation

- Defining the Problem Space
- A Programming Example
- Bit Wise Operators
- Bit Manipulation Functions
- Circular Shifts

Chapter 8: Strings

- Fundamental Concepts
- Aggregate Operations
- String Functions
- String Functions Example

Chapter 9: Higher Dimensional Arrays

- Array Dimensions
- An Array as an Argument to a Function
- Two-Dimensional Array Example
- String Arrays

Chapter 10: Separate Compilation

- Compiling Over Several Files
- Function Scope
- File Scope
- Program Scope
- Local static
- Object Files
- Libraries
- The C Loader
- Header Files

Chapter 11: Pointers (Part 1)

- Fundamental Concepts
- Pointer Operators and Operations
- Changing an Argument with a Function Call
- Pointer Arithmetic
- Array Traversal
- String Functions with Pointers
- Pointer Difference
- Prototypes for String Functions
- Relationship Between an Array and a Pointer
- The Pointer Notation *p++

Chapter 12: Pointers (Part 2)

- Dynamic Storage Allocation – malloc
- Functions Returning a Pointer
- Initialization of Pointers
- An Array of Character Pointers
- Two Dimensional Arrays vs. Array of Pointers
- Command Line Arguments
- Pointers to Pointers
- Practice with Pointers
- Function Pointers

Chapter 13: Structures

- Fundamental Concepts
- Describing a Structure
- Creating Structures
- Operations on Structures
- Functions Returning Structures
- Passing Structures to Functions
- Pointers to Structures
- Array of Structures
- Functions Returning a Pointer to a Structure

Chapter 14: Structure Related Items

- Bit Fields

- Non-Homogeneous Arrays
- Enumerations

Chapter 15: File I/O

- System Calls vs. Library Calls
- Opening Disk Files
- I/O Library Functions
- Copying a File
- Character Input vs. Line Input
- Servicing Errors – errno.h

Chapter 16: Information About Files

- The stat Function
- File Existence
- Telling Time – time and ctime
- Telling Time – localtime

Chapter 17: I/O With Structures

- A Database Application
- The menu Function
- The create_db Function
- The print_db Function
- The retrieve_db Function
- The Utility Functions

Appendix A: C Language Programming

- Important Header Files
- printf Formats
- C Reserved Words
- Conversion
- Precedence Chart

Appendix B: Useful Library Functions

- Math Functions
- Character Testing Functions
- Binary Search – bsearch

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