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Introduction to 'C' Language - Module 2

Data Types, Header Files and Input - Output in C

Data types specify the type of data that variables can store and the operations that can be performed on them. C supports various data types, including:

- Basic Data Types: int, float, char, double, etc.
- Derived Data Types: Arrays, structures, unions, pointers, etc.

Data Type	Description	Size (bytes)	Format Specifier	Range
int	Integer	2 or 4	%d	-32,768 to 32,767 (for 2 bytes) -2,147,483,648 to 2,147,483,647 (for 4 bytes)
char	Character	1	%c	-128 to 127 or 0 to 255 (if unsigned)
float	Single-precision floating point	4	%f	1.2E-38 to 3.4E+38
double	Double-precision floating point	8	%lf	2.3E-308 to 1.7E+308
short int	Short integer	2	%hd	-32,768 to 32,767
long int	Long integer	4 or 8	%ld	-2,147,483,648 to 2,147,483,647 (for 4 bytes) -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
long double	Extended precision floating point	10	%Lf	3.4E-4932 to 1.1E+4932

Header files in C

Header files in C are files that contain declarations of functions, variables, constants, macros, and other constructs that are shared across multiple source files in a C program. These files typically have a .h extension and are included at the beginning of a C source file using the #include preprocessor directive. Header files serve several purposes, including:

- Modularity: Header files help organize code into logical modules, making it easier to manage and maintain large projects.
- Code Reusability: By placing common declarations in header files, multiple source files can share the same functionality without duplicating code.
- Encapsulation: Header files hide the implementation details of functions and structures, providing only the necessary interface to the user.

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- **Compile-Time Checking:** Header files provide declarations that enable the compiler to perform type checking and catch errors early in the development process.

Here are some **commonly used header files in C** and their purposes:

- **stdio.h:** Provides input and output functionality, including functions like printf, scanf, fopen, fclose, etc.
- **stdlib.h:** Contains general utility functions, memory allocation functions (malloc, calloc, realloc, free), and other system-related functions.
- **string.h:** Contains functions for manipulating strings, such as strcpy, strcat, strlen, strcmp, etc.
- **math.h:** Provides mathematical functions like sqrt, pow, sin, cos, tan, log, exp, etc.
- **limits.h:** Contains constants that represent the limits of various data types, such as INT_MAX, INT_MIN, CHAR_BIT, etc.

INPUT - OUTPUT IN C

When we are saying Input that means we feed some data into program. This can be given in the form of file or from command line. C programming language provides a set of built-in functions to read given input and feed it to the program as per requirement.

When we are saying Output that means to display some data on screen, printer or in any file. C programming language provides a set of built-in functions to output the data on the computer screen

Input and output (I/O) operations in C are performed using standard library functions provided by the stdio.h header file.

Standard Input/Output Functions:

printf():

- Used to print formatted output to the console.
- Syntax: int printf(const char *format, ...);

scanf():

- Used to read formatted input from the console.
- Syntax: int scanf(const char *format, ...);

getchar():

- Used to read a single character from the console.
- Syntax: int getchar(void);

putchar():

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- Used to write a single character to the console.
- Syntax: `int putchar(int character);`

Example of Input - Output in C

```
#include <stdio.h>

int main() {
    // Declare variables
    int number;
    float floatValue;
    char character;

    // Prompt user for input
    printf("Enter an integer: ");
    scanf("%d", &number);

    printf("Enter a floating-point value: ");
    scanf("%f", &floatValue);

    printf("Enter a character: ");
    scanf(" %c", &character); // Note: There is a space before %c to consume any whitespace

    // Display output
    printf("\nYou entered:\n");
    printf("Integer: %d\n", number);
    printf("Float: %.2f\n", floatValue); // Displaying with 2 decimal places
    printf("Character: %c\n", character);

    return 0;
}
```

Enter an integer: 10
Enter a floating-point value: 3.14
Enter a character: A

You entered:
Integer: 10
Float: 3.14
Character: A

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Solved Questions

Ques 1: Write a simple program that prints "Hello, World!" to the console using printf.

Sol:

```
c Copy code  
  
#include <stdio.h>  
  
int main() {  
    printf("Hello, World!\n");  
    return 0;  
}
```

Ques 2: Write a program that takes two numbers as input from the user using scanf, calculates their sum, and prints the result using printf.

```
c Copy code  
  
#include <stdio.h>  
  
int main() {  
    int num1, num2, sum;  
  
    printf("Enter first number: ");  
    scanf("%d", &num1);  
  
    printf("Enter second number: ");  
    scanf("%d", &num2);  
  
    sum = num1 + num2;  
  
    printf("Sum: %d\n", sum);  
  
    return 0;  
}
```

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Assignment

1. **Temperature Conversion:** A program that takes the temperature in Celsius as input using scanf, converts it to Fahrenheit, and prints the result using printf.

$$\text{Tem}^{\circ} \text{F} = (\text{Tem}^{\circ} \text{C} \times 9) / 5 + 32$$

2. **Area of a Rectangle:** A program that takes the length and width of a rectangle as input using scanf, calculates its area, and prints the result using printf.

$$\text{Area of Rectangle} = \text{length} \times \text{breadth}$$

3. **Simple Interest:** A program that takes principal amount, rate of interest, and time period as input using scanf, calculates simple interest, and prints the result using printf.

$$\text{Simple Interest} = (P \times R \times T) / 100$$

4. **Volume of a Sphere:** A program that takes the radius of a sphere as input using scanf, calculates its volume, and prints the result using printf.

$$\text{Volume of Sphere} = 4/3 \pi r^3$$

5. **BMI Calculator:** A program that takes weight (in kilograms) and height (in meters) as input using scanf, calculates the Body Mass Index (BMI), and prints the result using printf.

$$\text{BMI} = \text{weight} / \text{height}^2$$



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