

Arrays and Strings in C Language

Module 05 - Introduction to Strings and String Manipulation in C Language

A string is a series of characters treated as a single unit. A string may include letters, digits and various special characters such as +, -, *, / and \$. String literals or string constants in C are written in double quotation marks as follows:

- "1000 Main Street" (a street address)
- "(080)329-7082" (a telephone number)
- "Red Fort, New Delhi" (a city)

In C language strings are stored in array of char type along with null terminating character '\0' at the end.

When sizing the string array we need to add plus one to the actual size of the string to make space for the null terminating character, '\0'.

Syntax:

```
char fname[4];
```

The above statement declares a string called fname that can take up to 3 characters. It can be indexed just as a regular array as well.

```
fname[]={ 't', 'w', 'o' };
```

Generalized Syntax is

```
char str[size];
```

when we declare the string in this way, we can store size -1 characters in the array because the last character would be the null character.

For example, char mesg[10]; can store maximum of 9 characters.

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Reading strings:

If we declare a string by writing `char str[100]`; then `str` can be read from the user by using three ways;

1. Using `scanf()` function.
2. Using `gets()` function.
3. Using `getchar()`, `getch()`, or `getche()` function repeatedly.

Using scanf() Function

The `scanf()` function is typically used to read input from the user. It reads until it encounters a space, newline, or tab.

This means that it can only capture a single word (without spaces). It is suitable when you need to input a string without spaces, such as a single word.

Example:

```
c Copy code  
  
#include <stdio.h>  
int main() {  
    char str[100];  
    printf("Enter a string: ");  
    scanf("%s", str); // Reads a word (stops at the first space)  
    printf("You entered: %s\n", str);  
    return 0;  
}
```

Limitation: `scanf()` stops reading when it encounters a space or newline character, so it is not ideal for strings containing multiple words or spaces.

Using gets() Function

The `gets()` function is a legacy function that reads a line of text, including spaces, from the user until the newline character (`\n`) is encountered. However, it is **not safe** to use, as it does not check the size of the buffer and can lead to buffer overflow if the input is too long.

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Example

```
c Copy code
#include <stdio.h>
int main() {
    char str[100];
    printf("Enter a string: ");
    gets(str); // Reads a full line including spaces (unsafe)
    printf("You entered: %s\n", str);
    return 0;
}
```

Using getchar(), getch(), or getche() Functions Repeatedly

These functions allow you to read individual characters from the user one at a time. You can loop through them to read a string. This method gives you control over how characters are read and stored.

Example using `getchar()` :

```
c Copy code
#include <stdio.h>
int main() {
    char str[100];
    int i = 0;
    char ch;
    printf("Enter a string: ");
    while ((ch = getchar()) != '\n' && i < 99) { // Read until newline
        str[i++] = ch;
    }
    str[i] = '\0'; // Null-terminate the string
    printf("You entered: %s\n", str);
    return 0;
}
```

Writing string:

The string can be displayed on screen using three ways:

1. Using printf() function
2. Using puts() function
3. Using putchar() function repeatedly

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Using printf() Function

The printf() function is a versatile and widely used function for displaying output in C. It allows you to print formatted strings, including strings stored in character arrays.

Example:

```
c Copy code
#include <stdio.h>
int main() {
    char str[] = "Hello, World!";
    printf("%s\n", str); // %s is used to print a string
    return 0;
}
```

Explanation:

- %s is a format specifier for strings.
- The string stored in str will be printed, followed by a newline character (\n).

Using puts() Function

The puts() function is specifically designed for printing strings. It automatically appends a newline character at the end of the output, making it convenient for displaying strings on separate lines.

```
c Copy code
#include <stdio.h>
int main() {
    char str[] = "Hello, World!";
    puts(str); // Automatically prints the string with a newline
    return 0;
}
```

Explanation:

- Unlike printf(), you don't need to use a format specifier or manually add a newline (\n).
- It is simpler to use when you just want to display a string.

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Using putchar() Function Repeatedly

The putchar() function is used to print a single character at a time. To display a string, you can loop through each character of the string and use putchar() repeatedly.

```
c Copy code
#include <stdio.h>
int main() {
    char str[] = "Hello, World!";
    int i = 0;
    while (str[i] != '\0') { // Loop until the null character is reached
        putchar(str[i]);    // Print each character
        i++;
    }
    putchar('\n'); // Add a newLine at the end
    return 0;
}
```

Explanation:

- putchar() prints one character at a time.
- You need to manually handle the newline after printing the string.

Solved Example: Read and Display a String

```
#include<stdio.h>
#include<conio.h>
void main()
{
    char str[20];
    clrscr();
    printf("\n Enter a string:\n");
    gets(str);
    scanf("The string is:\n");
    puts(str);
    getch(); }
```



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Assignment

Ques 1: Write a C program to enter and display multiple pieces of information like Name, Father's Name, Age and Address of 3 students using loops and string.

Ques 2: Write a program to input the following details for a student and display them:

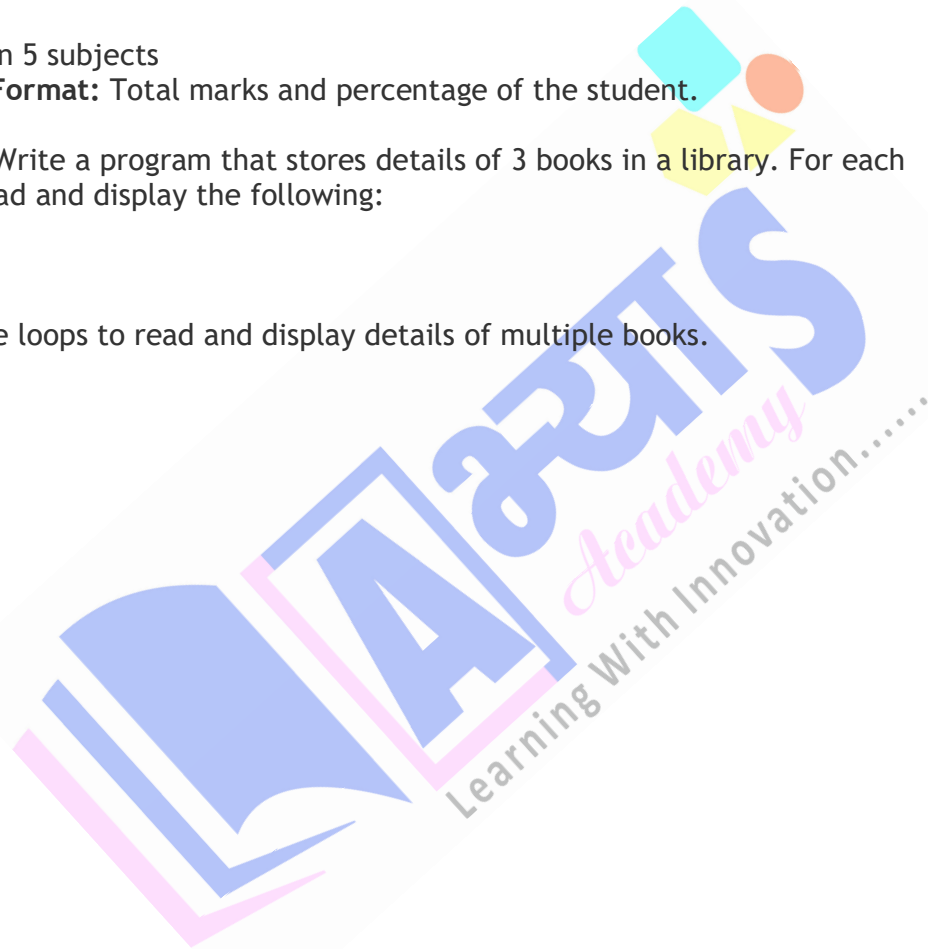
- Name
- Roll Number
- Class
- Marks in 5 subjects

Output Format: Total marks and percentage of the student.

Ques 3: Write a program that stores details of 3 books in a library. For each book, read and display the following:

- Title
- Author
- Price

Hint: Use loops to read and display details of multiple books.



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Solved Example: Search for a Character in a String

```
c Copy code  
  
#include <stdio.h>  
  
int main() {  
    char str[100], ch;  
    int i, found = 0;  
  
    // Reading a string  
    printf("Enter a string: ");  
    gets(str);  
  
    // Reading character to search  
    printf("Enter a character to search: ");  
    ch = getchar();  
  
    // Searching for the character  
    for (i = 0; str[i] != '\0'; i++) {  
        if (str[i] == ch) {  
            printf("Character '%c' found at position %d\n", ch, i + 1);  
            found = 1;  
            break; // Exit the loop after finding the first occurrence  
        }  
    }  
  
    if (!found) {  
        printf("Character '%c' not found in the string.\n", ch);  
    }  
  
    return 0;  
}
```

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