◇ 1D Array in C

What is it?

- A linear collection of elements of the same data type.
- Accessed using a single index.

Syntax:

```c
int arr[5];                         // Declaration
int arr[5] = {1, 2, 3, 4, 5};       // Initialization

```

Key Operations:

- **Access:** arr[0], arr[i]
- **Traversing:** for(i = 0; i < 5; i++)
- **Modify Value:** arr[2] = 99;
- **Input:** scanf("%d", &arr[i]);
- **Output:** printf("%d", arr[i]);
- **Sum, Max, etc.:** Using loops
- **Passing to Functions:** By reference (changes affect the original array)

Notes:

- Indexing starts from 0.
- The size is fixed once declared.
- Changes inside functions affect the original array.

◇ 2D Array in C

What is it?

- A matrix-like structure with rows and columns.

Syntax:

```
1  int arr[2][3];                                  // Declaration
2  int arr[2][3] = { {1, 2, 3}, {4, 5, 6} };       // Initialization
```

Key Concepts:

- **Access:** arr[i][j]
- **Input/Output:** Use nested for loops
- **Passing to Functions:** Specify column size, e.g., void func(int arr[][3])

Common Operations:

- Traversing elements
- Sum of elements
- Matrix operations: addition, multiplication, transpose

Notes:

- Stored in row-major order.
- All rows must have the same number of columns.

◇ Strings in C

What is it?

- A character array ending with a null character '\0'.

Declaration & Initialization:

```c
char str[] = "hello";                    // Preferred way
char str[6] = {'h','e','l','l','o','\0'};  // Manual way
```

Input & Output:

- scanf("%s", str); ← Reads a word (without spaces)
- fgets(str, size, stdin); ← Reads a full line (with spaces)

Useful Functions (from <string.h>):

- strlen(str) ← Length of string
- strcpy(dest, src) ← Copy string
- strcat(s1, s2) ← Concatenate two strings
- strcmp(s1, s2) ← Compare two strings

Common Operations:

Operation	Function
Length	strlen(str)
Copy	strcpy(dest, src)
Concatenate	strcat(s1, s2)
Compare	strcmp(s1, s2)
Read Full Line	fgets(str, size, stdin)
Reverse String	Loop & swap characters
Check Palindrome	Compare characters manually
Count Characters	Loop with conditions

Notes:

- Always allocate extra space for '\0'.
- Strings are arrays, not objects.
- Manual operations require loops and conditions.