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◇ What is a Structure in C++?

A **structure (`struct`)** in C++ is a **user-defined data type** that allows you to store **different types of data under one name**.

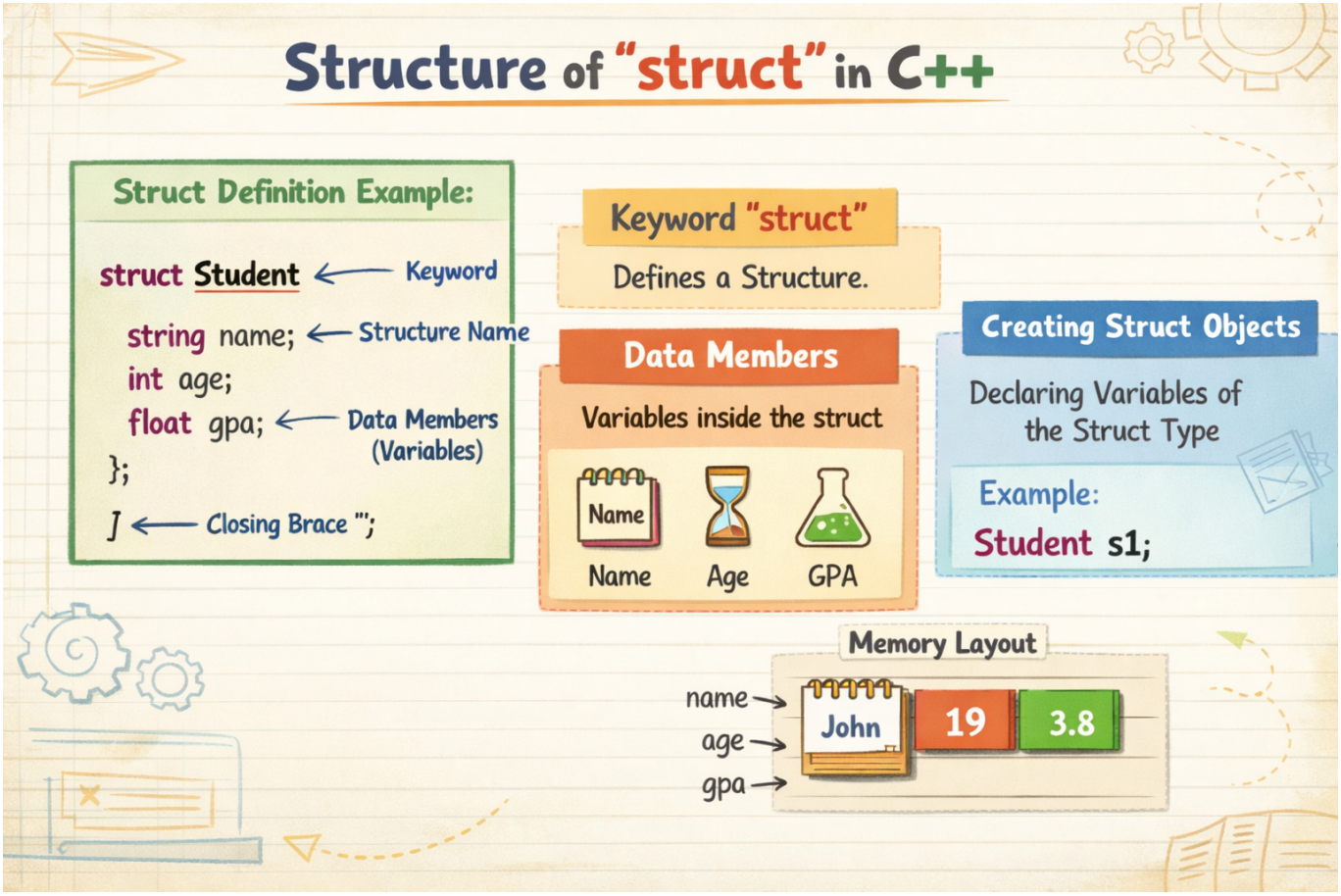
👉 It is useful when you want to group **related data** together.

Example (Real Life):

A **Student** has:

- Roll number (int)
- Name (string)
- Marks (float)

All these can be grouped using a **structure**.



◇ Declaring a Structure

Syntax:

```
struct StructureName {
    dataType member1;
```

```
    dataType member2;
};
```

Example:

```
struct Student {
    int rollNo;
    string name;
    float marks;
};
```

✔ This only **defines the structure**, no memory is allocated yet.

◇ Defining Structure Variables

After declaring a structure, you can create variables of that structure.

Example:

```
Student s1;
```

Now `s1` can store student data.

◇ Accessing Structure Members

Use the **dot (.) operator** to access members.

Example:

```
#include <iostream>
using namespace std;

struct Student {
    int rollNo;
    string name;
    float marks;
};

int main() {
    Student s1;

    s1.rollNo = 101;
    s1.name = "Ali";
    s1.marks = 85.5;
```

```
    cout << s1.rollNo << endl;
    cout << s1.name << endl;
    cout << s1.marks << endl;

    return 0;
}
```

◇ Initializing Structure Variables

Method 1: Initialization at declaration

```
Student s1 = {101, "Ahmed", 90.5};
```

Method 2: Member-wise initialization

```
Student s1;
s1.rollNo = 102;
s1.name = "Sara";
s1.marks = 88.0;
```

◇ Assigning One Structure Variable to Another

In C++, you can **directly assign one structure to another** of the same type.

Example:

```
Student s1 = {101, "Ali", 85};
Student s2;

s2 = s1;   // Copy all values

cout << s2.name;   // Output: Ali
```

✔ All members are copied automatically.

◇ Array as Members of Structure

A structure member can also be an **array**.

Example:

```
struct Student {
    int rollNo;
    char name[20];
    int marks[3];
};
```

Example Program:

```
#include <iostream>
using namespace std;

struct Student {
    int rollNo;
    char name[20];
    int marks[3];
};

int main() {
    Student s1;

    s1.rollNo = 101;
    strcpy(s1.name, "Ali");

    s1.marks[0] = 80;
    s1.marks[1] = 75;
    s1.marks[2] = 90;

    cout << "Roll No: " << s1.rollNo << endl;
    cout << "Name: " << s1.name << endl;

    cout << "Marks: ";
    for(int i = 0; i < 3; i++) {
        cout << s1.marks[i] << " ";
    }

    return 0;
}
```

◇ Structure with Array of Structures (Common Use)

```
Student students[2] = {
    {101, "Ali", 85},
    {102, "Sara", 90}
};
```

◇ Why Use Structures?

✔ Group related data ✔ Improve code readability ✔ Used in real-world data (students, employees, products) ✔ Foundation for **classes** in OOP

◇ Key Points

- `struct` groups different data types
- Access members using dot (`.`)
- Structures can be copied directly
- Structures can contain arrays
- Structures make programs **organized and meaningful**

◇ Example: Structure for Book Information

▨ Problem Statement

Store and display information of a book using **structure**.

◇ Step 1: Declare the Structure

```
struct Book {
    int bookId;
    string title;
    float price;
};
```

◇ Step 2: Complete Program Example

```
#include <iostream>
using namespace std;

struct Book {
    int bookId;
    string title;
    float price;
};

int main() {
    // Defining structure variable
    Book b1;

    // Assigning values
    b1.bookId = 1;
    b1.title = "C++ Basics";
```

```
    b1.price = 550.75;

    // Displaying values
    cout << "Book ID: " << b1.bookId << endl;
    cout << "Title: " << b1.title << endl;
    cout << "Price: " << b1.price << endl;

    return 0;
}
```

◇ Output

```
Book ID: 1
Title: C++ Basics
Price: 550.75
```

◇ Example with Initialization at Declaration

```
Book b2 = {2, "Programming Fundamentals", 620.50};

cout << b2.bookId << endl;
cout << b2.title << endl;
cout << b2.price << endl;
```

◇ Example: Assigning One Structure to Another

```
Book b3;
b3 = b2;   // Copy all data

cout << b3.title;   // Output: Programming Fundamentals
```

◇ Example: Structure for Employee Information

📌 Problem Statement

Store and display employee details using a **structure**.

◇ Step 1: Declare the Structure

```
struct Employee {
    int empId;
    string name;
    float salary;
};
```

◇ Step 2: Complete Program

```
#include <iostream>
using namespace std;

struct Employee {
    int empId;
    string name;
    float salary;
};

int main() {
    // Defining structure variable
    Employee e1;

    // Assigning values
    e1.empId = 1001;
    e1.name = "Ahmed";
    e1.salary = 45000.50;

    // Displaying values
    cout << "Employee ID: " << e1.empId << endl;
    cout << "Employee Name: " << e1.name << endl;
    cout << "Employee Salary: " << e1.salary << endl;

    return 0;
}
```

◇ Output

```
Employee ID: 1001
Employee Name: Ahmed
Employee Salary: 45000.5
```

◇ Example with Initialization at Declaration

```
Employee e2 = {1002, "Sara", 52000};
```

◇ Example: Copying One Structure Variable to Another

```
Employee e3;
e3 = e1;   // Copy data

cout << e3.name;   // Output: Ahmed
```

Related Topics

- C++ One-Dimensional Arrays — Syntax & Examples