Object Oriented Programming (OOP)

Semester: 2nd
Credit Hour: (01)
Department of Computer Science
Course Instructor: Engr. Zakria Bacha

Lab Task No. 4

Structure in C++

Previous Lab:

In previous lab, we have covered below three topics:

1. **Creating a 2-D array dynamically**
2. **Storing data in a 2-D array**
3. **Processing data using nested loops**
4. **Using pointers to access 2-D arrays**

Current Topics for Lab:

1. **Structure**
2. **Array of Structure**
3. **Nested Structure**

What is a Structure in C++:

Structure is a **user-defined data type**. It is like a container that allows multiple variables to be grouped together. Structures are used to organize **related data** (variables) into a nice neat package.

Structure Declaration Syntax:

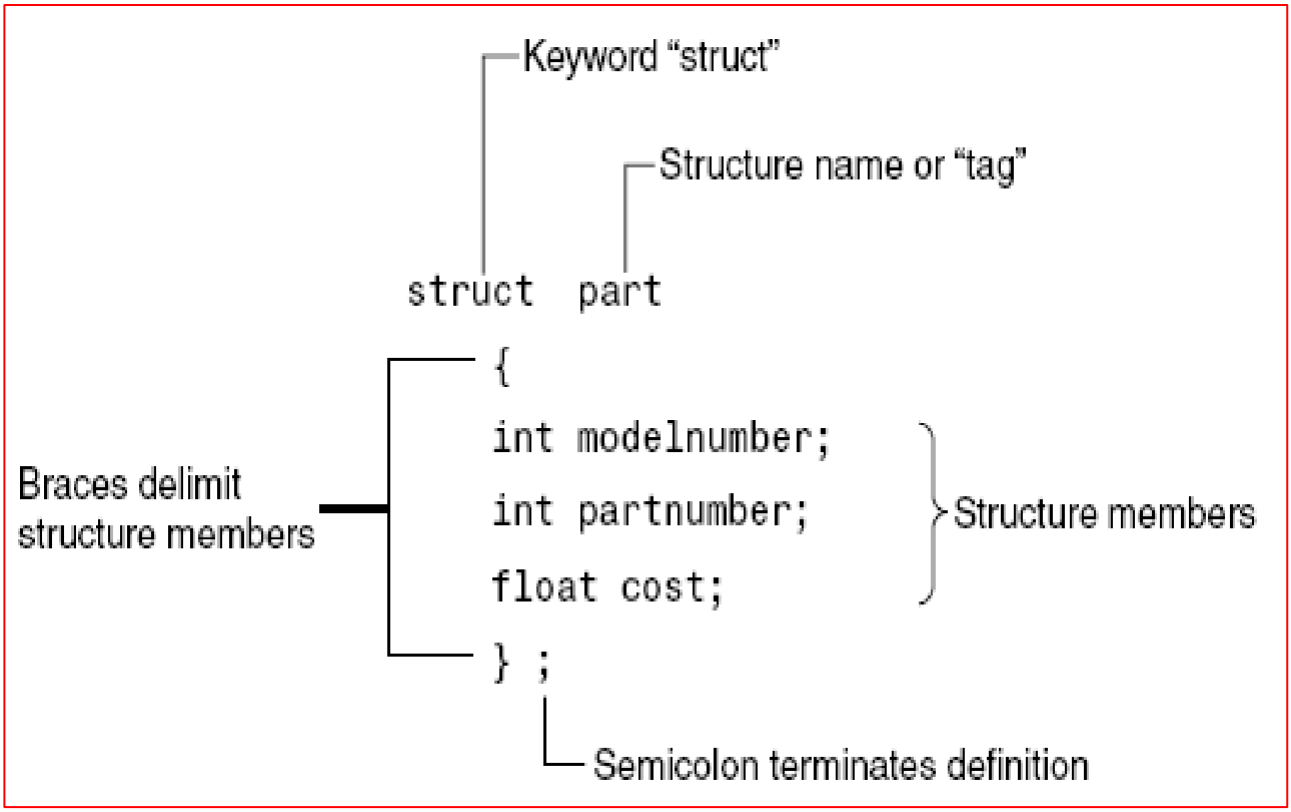


Figure 1

Structure Declaration in Dev C++:

We can define a structure using the keyword **struct** and define three **member variables.**

```
2  struct Car_Parts{
3
4      int modelNumber;
5      int partNumber;
6      float cost;
7  };
```

Figure 2

Size of Structure in Bytes:

Diagram: Below diagram shows how memory is allocated for structure (Members variable).

The **sizeof** operator is a **unary Operator,** used to determine the **memory size (in bytes)** of variables, data types, constants, as well as user-defined types such as structures, and classes.

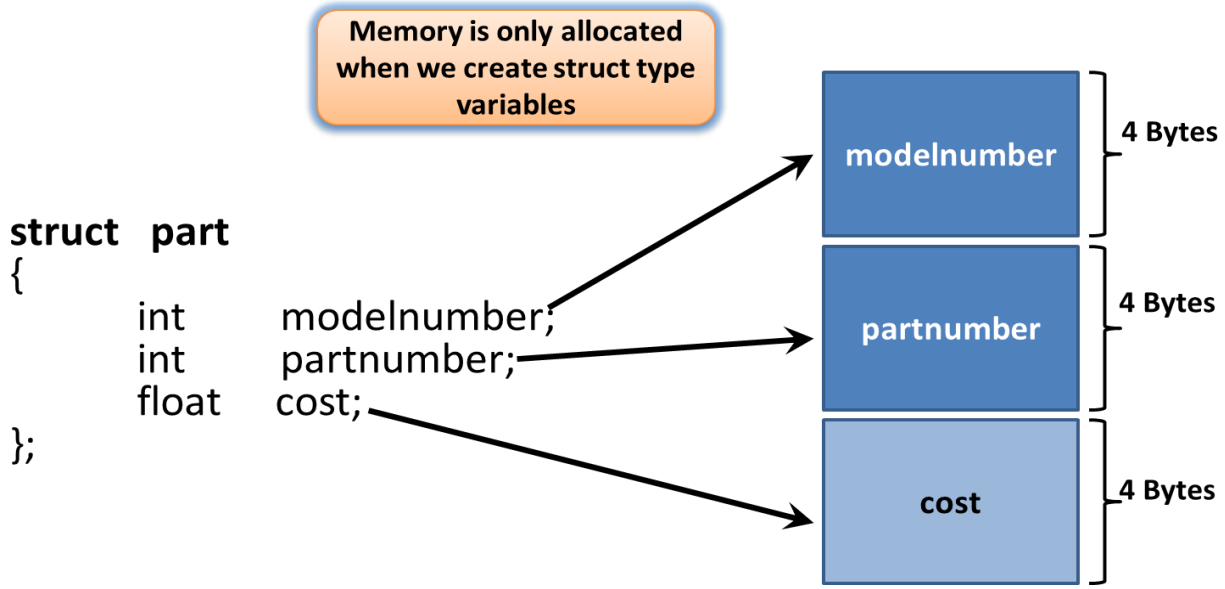


Figure 2

How to Initialize structure variable in C++?

There are two Ways to initialize structure variable.

1st Method: (Initialization at declaration)

```
1  struct Student{
2
3      // Structure Members
4      int studentId;
5      string studentName;
6      short yearInSchool;
7      double gpa;
8  };
9  // You should follow the order
10 student s1 = {6969, "Ali", 2, 3.75}
```

Figure 3

2nd Method: (Initialization using object)

```
10 int main()
11 {
12     // Use the dot (.) operator to refer
13     // to member of struct variables.
14     cin >> s1.studentID;
15     s1.name = "zakria";
16     s1.gpa = 3.75;
17     return 0;
```

Array of Structure in C++:

You should use square brackets [].

Step 01:

```
#include<iostream>
using namespace std;
struct Book{
    // Structure Members
    int ID;
    int pages;
    float price;
};
// You should follow the order
int main(){

    Book Library[100]; // Declare array of structure

```

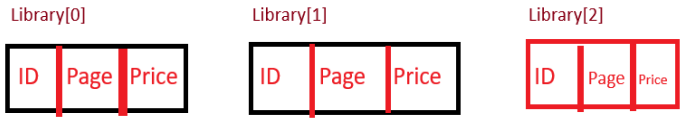


Figure 4

Step 2: Usage of for Loop for Array of Structure

Here, we are taking data for multiple books. And each book contains multiple data members.

```
int main()
{
    Book Library[100];

    for(int i=0; i<100; i++)
    {
        cin>>Library[i].ID;
        cin>>Library[i].Pages;
        cin>>Library[i].Price;
    }
```

Nested Structure:

A structure variable can be a member of another structure: called nested structure.

```
// Inner structure
struct Camera {
    int megapixels;
    string type;
};

// Outer structure
struct Mobile {
    Camera cam;    // nested structure variable
    float price;   // second variable
};
```

Figure 5

Accessing Member of Nested Structure:

```
int main()
{
    // Structure instance variable
    Mobile m;
    // Access Camera member variable via
    // Outer structure Mobile instance
    m.cam.megapixels = 1200;


    return 0;
}
```

Figure 6

Summary:

1st Type:

Aspect	Traditional Data Type	Structure
Data stored	Single value	Multiple related values
Example	int, float, char	struct Student
Usage	Simple data	Complex records
Real-world fit	Low	High

2nd Type:

Aspect	Traditional Array	Structure Array
Data type	Same type	Multiple data types
Example	int marks[50]	Student s[50]
Stores	One attribute	Complete records
Use case	Simple lists	Databases-like data

3rd Type:

Aspect	Simple Structure	Nested Structure
Definition	Structure with basic members only	Structure containing another structure
Complexity	Simple	More organized

Example	Student	Student → Address
Usage	Small programs	Large systems

Lab Task No.1

- Define a structure called "Car" in global scope. The member elements of the car structure are:

    1. **string Model;**
    2. **int Year;**
    3. **float Price**

- Create an array of 3 cars called showroom. Get input for all 3 cars from the user. Then the program should display complete information (*Model*, *Year*, *Price*) of those cars only which are above 500,000 in price.

Note:

Input:

Enter details of 3 cars:
Car 1
Model: Corolla
Year: 2019
Price: 450000

Car 2 // Enter data as used for above car
Car 3 // Enter data as used for above car

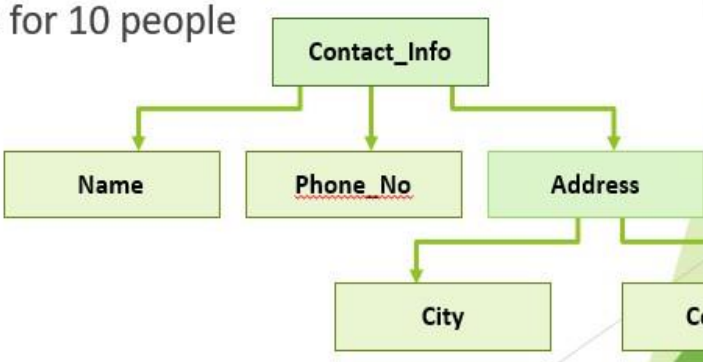
Output:

Cars with price above 500000:

Model: Civic
Year: 2021
Price: 650000

Lab Task No.2 (Use Nested Structure)

- Write a program that implements the following using C++ struct. The program should finally display contact_Info values for 10 people



Object Oriented Programming-Spring 23 34

Input:

Enter details for Person 1

Name: Ali Khan
Phone Number: 0301-1234567
City: Peshawar
Country: Pakistan

Output:

Contact Information:

Name: Ali Khan
Phone Number: 0301-1234567
City: Peshawar
Country: Pakistan