CS118 Programming Fundamentals

LAB 10

STRUCTURES in C

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES

C Structures

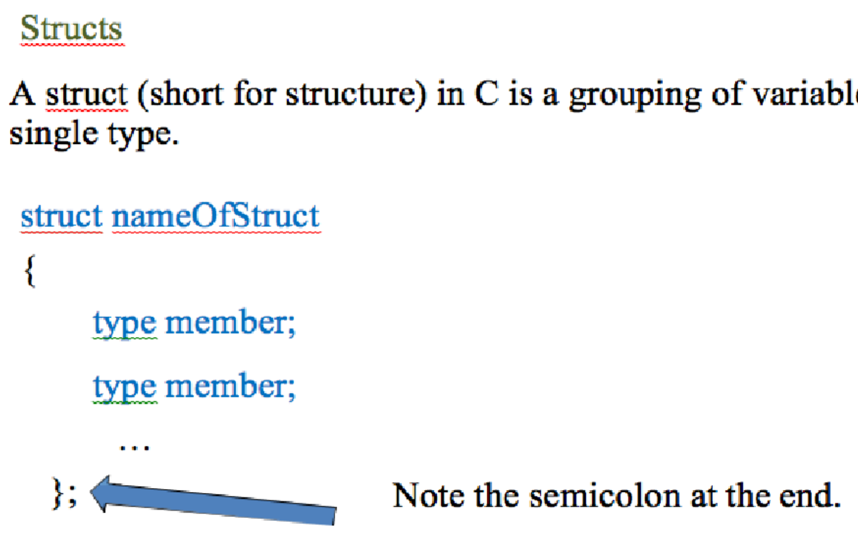
C arrays allow you to define type of variables that can hold several data items of the same kind but structure is another user defined data type available in C programming, which allows you to combine data items of different kinds.

Structure is the collection of heterogeneous data items unlike an array. Structure can also be defined as a collection of a fixed number of components in which the components are accessed by name. The components may be of different types. All the data items in a structure may or may not be of same data type. There are some data items, which are group of multiple values instead of a single value. In short, Structures are used to represent a record.

Example: Suppose you want to keep track of your books in a library. You might want to track the following attributes about each book:

- Title,
- Author,
- Subject
- Book ID

Defining a Structure



Structs

A struct (short for structure) in C is a grouping of variables together into a single type.

```
struct nameOfStruct
{
     type member;
     type member;
       ...
  };
```

Note the semicolon at the end.

```
struct Books
{
     char    title[50];
     char    author[50];
     char    subject[100];
     int     book_id;
}b1,b2,phy;
```

Struct Books b1,b2,phy;

Declaring a Structure

To declare a Structure variable:

Syntax: struct nameOfStruct variable_name;

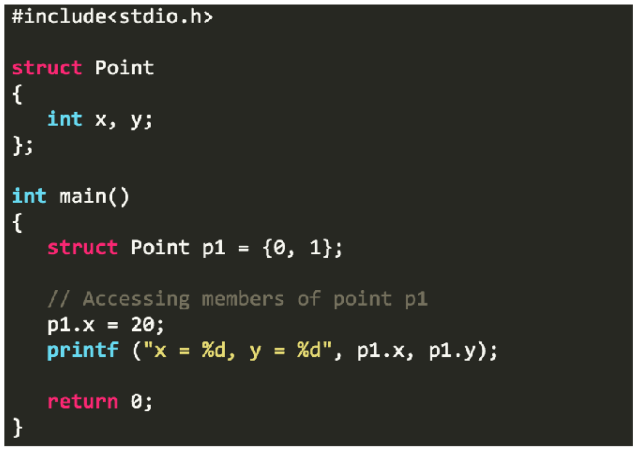
Example: struct Books Book1;

Another Example:

```
struct Person {
            char name[50];
             int  citNo;
             float salary;
};

int main() {
struct Person person1, person2, p[20]; return 0;
}
```

Accessing a Structure:

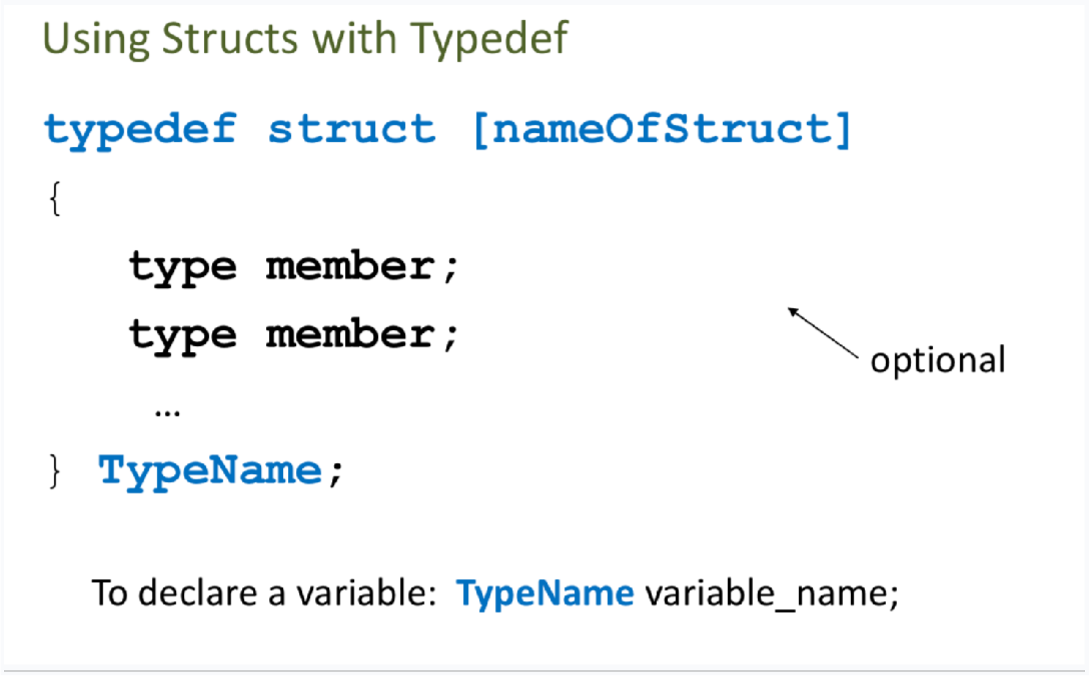
Once structure is defined and its variable is created, we can access the individual members of the structure with the help of dot operator (.). The dot operator is also called as member access operator.



```c
#include<stdio.h>

struct Point
{
   int x, y;
};

int main()
{
   struct Point p1 = {0, 1};

   // Accessing members of point p1
   p1.x = 20;
   printf ("x = %d, y = %d", p1.x, p1.y);

   return 0;
}
```

Another Example:

```c
#include <stdio.h>
#include <string.h>

struct Books
{
    char    title[50];
    char    author[50];
    char    subject[100];
    int     book_id;
} Book1, Book2;

int main( )
{

    /* book 1 specification */
    strcpy( Book1.title, "CProgramming");
    strcpy( Book1.author, "Nuha Ali");
    strcpy( Book1.subject, "C ProgrammingTutorial");
    Book1.book_id = 6495407;

    /* book 2 specification */
    strcpy( Book2.title, "TelecomBilling");
    strcpy( Book2.author, "Zara Ali");
    strcpy( Book2.subject, "Telecom Billing Tutorial");
    Book2.book_id = 6495700;

    /* print Book1 info */
    printf( "Book 1 title : %s\n", Book1.title);
    printf( "Book 1 author : %s\n", Book1.author);
    printf( "Book 1 subject : %s\n", Book1.subject);
    printf( "Book 1 book_id : %d\n",
    Book1.book_id);

    /* print Book2 info */
    printf( "Book 2 title : %s\n", Book2.title);
    printf( "Book 2 author : %s\n", Book2.author);
    printf( "Book 2 subject : %s\n",
    Book2.subject);
    printf("Book 2 book_id : %d\n",
    Book2.book_id);

    return 0;
}
```



Using Structs with Typedef

```
typedef struct [nameOfStruct]
{
     type member;
     type member;                 optional
      ...
} TypeName;
```

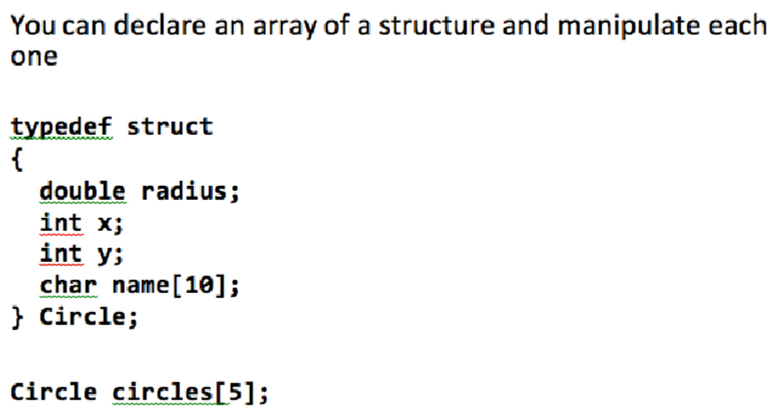
To declare a variable: TypeName variable_name;

```
#include <stdio.h>
typedef struct
{
        int width;
        int length;
        int height;
} Box;
typedef struct {  double radius; } Circle;
int main()
{
        Box b;   /* instead of struct Box */
        Circle c;/* instead of struct Circle */
        b.width = 10;
        b.length = 30;
        b.height = 10;
        c.radius = 10;
}
```

Size of a Struct: sizeof

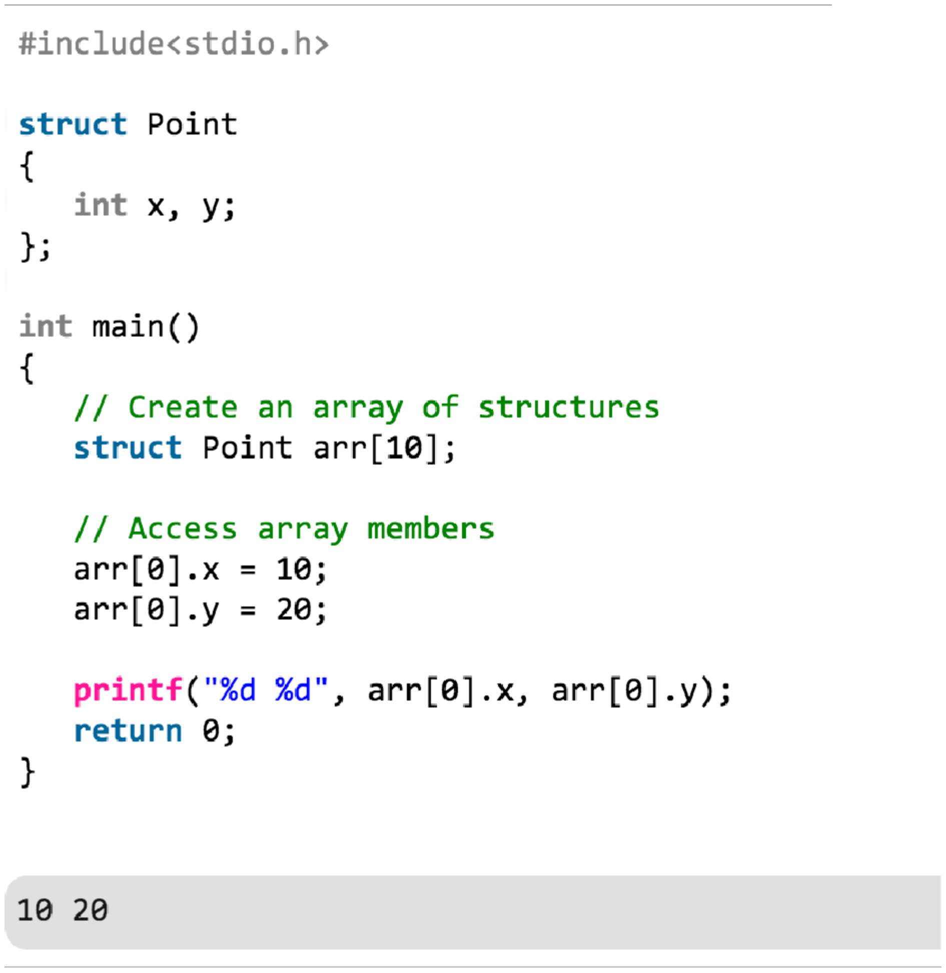
```
typedef struct
{
  double radius;      /* 8 bytes */
  int x;              /* 4 bytes */
  int y;              /* 4 bytes */
  char name[10];      /* 10 bytes */
} Circle;

printf("Size of Circle struct is %d\n",
        sizeof(Circle));
```

Array of Structures



You can declare an array of a structure and manipulate each one

```
typedef struct
{
  double radius;
  int x;
  int y;
  char name[10];
} Circle;

Circle circles[5];
```



```
#include<stdio.h>

struct Point
{
   int x, y;
};

int main()
{
   // Create an array of structures
   struct Point arr[10];

   // Access array members
   arr[0].x = 10;
   arr[0].y = 20;

   printf("%d %d", arr[0].x, arr[0].y);
   return 0;
}
```

```
10 20
```

LAB TASK

1. Write a program in C that creates structure STUDENT. The STUDENT structure contains the following members: Name, Roll number, Attendance Marks, Test1 marks, Test2 marks and Test3 marks. Initialize two variables to store the record of two students. The program should display the name; roll number and total sessional marks of both the students.

2. Write a program in C that creates structure TIME. Initialize two variables to store the starting and ending time of the race. The program should calculate the elapsed time in the third TIME variable and display it.

3. Calculate the average Salary of the 10 employees by adding a function in the TASK 3.

4. Calculate the Sizeof() Struct EMPLOYEE.

5. Write a program to compare two dates entered by user. Make a structure named Date to store the elements day, month and year to store the dates. If the dates are equal, display "Dates are equal" otherwise display "Dates are not equal".