Programming with C and C++

CSC-101 (Lecture 26)

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Structures in C

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

struct employee
{    int id;
     char name[50];
     float salary;
} e1,e2;  //declaring e1 and e2 variables for structure

int main( )
{
   //store first employee information
   e1.id=1;
   strcpy(e1.name, "KL Rahul");//copying string into char array
   e1.salary=5000000;

```

https://ideone.com/GHD7Jr

Structures in C

```
17      //store second employee information
18       e2.id=18;
19       strcpy(e2.name, "Virat");
20       e2.salary=10000000;
21
22       //printing first employee information
23       printf( "employee 1 id : %d\n", e1.id);
24       printf( "employee 1 name : %s\n", e1.name);
25       printf( "employee 1 salary : %.2f\n\n", e1.salary);
26
27       //printing second employee information
28       printf( "employee 2 id : %d\n", e2.id);
29       printf( "employee 2 name : %s\n", e2.name);
30       printf( "employee 2 salary : %.2f\n", e2.salary);
31       return 0;
32   }
33
```

Structures in C

```
Success #stdin #stdout 0s 5512KB
employee 1 id : 1
employee 1 name : KL Rahul
employee 1 salary : 5000000.00

employee 2 id : 18
employee 2 name : Virat
employee 2 salary : 10000000.00
```

Array of Structures

```
1  #include<stdio.h>
2  #include <string.h>
3
4      struct student{
5          int rollno;
6          char name[10];
7      };
8
9      int main(){
10     int i;
11     struct student st[3];
12     printf("Enter Records of 3 students");
13
```

https://ideone.com/qhBhmi

Array of Structures

```
14      for(i=0;i<3;i++){
15          printf("\nEnter Rollno:");
16          scanf("%d",&st[i].rollno);
17          printf("\nEnter Name:");
18          scanf("%s",&st[i].name);
19      }
20
21      printf("\nStudent Information List:");
22
23      for(i=0;i<3;i++){
24          printf("\nRollno:%d, Name:%s",st[i].rollno,st[i].name);
25      }
26      return 0;
27  }
28
```

stdin

```
1
Ravi
2
Rahul
3
Rohit
```

```
Student Information List:
Rollno:1, Name:Ravi
Rollno:2, Name:Rahul
Rollno:3, Name:Rohit
```

Pointers to Structures

```
struct Books Book1;

struct Books *struct_pointer;

struct_pointer = &Book1;

struct_pointer->title;
```

Structure Pointer in C

https://ideone.com/A3cVTj

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

struct Course
{
    char cou_name[40];
    int cou_id;
    char cou_duration[30];
    char cou_type[30];
};

int main()
{
    struct Course cou;
    struct Course *ptr;
    ptr = &cou;  // Assign the address of 'cou' to the pointer

```

Structure Pointer in C

```
18      strcpy(cou.cou_name, "Computer Science and Engineering");
19      cou.cou_id = 101;
20      strcpy(cou.cou_duration, "4 Months");
21      strcpy(cou.cou_type, "Theory and Practical");
22
23      printf("Course Name: %s\n", (*ptr).cou_name);
24      printf("Course ID: %d\n", (*ptr).cou_id);
25      printf("Duration of the Course: %s\n", (*ptr).cou_duration);
26      printf("Type of the Course: %s\n", (*ptr).cou_type);
27
28      return 0;
29  }
30
```

stdout

```
Course Name: Computer Science and Engineering
Course ID: 101
Duration of the Course: 4 Months
Type of the Course: Theory and Practical
```

Structure Pointer in C

https://ideone.com/XoZ8H4

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

struct Course
{
    char cou_name[40];
    int cou_id;
    char cou_duration[30];
    char cou_type[30];
};

int main()
{
    struct Course cou;
    struct Course *ptr;
    ptr = &cou;  // Assign the address of 'cou' to the pointer

```

Structure Pointer in C

```
18      strcpy(cou.cou_name, "Computer Science and Engineering");
19      cou.cou_id = 1201;
20      strcpy(cou.cou_duration, "6 Months");
21      strcpy(cou.cou_type, "Multiple Choice Question");
22
23      //Print the details of the Course
24      printf("Course Name: %s\n", ptr->cou_name);
25      printf("Course ID: %d\n", ptr->cou_id);
26      printf("Duration of the Course: %s\n", ptr->cou_duration);
27      printf("Type of the Course: %s\n", ptr->cou_type);
28
29      return 0;
30  }
31
```

stdout

```
Course Name: Computer Science and Engineering
Course ID: 101
Duration of the Course: 4 Months
Type of the Course: Theory and Practical
```

Addition of 2 Distances

https://ideone.com/3Bz7fU

```c
#include <stdio.h>
// Structure to represent distance
typedef struct {
    int feet;
    int inches;
} Distance;
// Function to add two distances
Distance addDistances(Distance d1, Distance d2) {
    Distance result;
    result.feet = d1.feet + d2.feet;
    result.inches = d1.inches + d2.inches;

    // Adjust inches to be less than 12
    if (result.inches >= 12) {
        result.inches -= 12;
        result.feet++;
    }

    return result;
}

```

```c
int main() {
    Distance distance1, distance2, sum;

    // Input first distance
    printf("Enter first distance (feet inches): ");
    scanf("%d %d", &distance1.feet, &distance1.inches);

    // Input second distance
    printf("Enter second distance (feet inches): ");
    scanf("%d %d", &distance2.feet, &distance2.inches);

    // Add the distances
    sum = addDistances(distance1, distance2);

    // Display the sum
    printf("Sum of distances: %d feet %d inches\n", sum.feet, sum.inches);

    return 0;
}
```

stdin

```
7 8
6 7
```

stdout

```
Enter first distance (feet inches): 7 8
Enter second distance (feet inches): 6 7
Sum of distances: 14 feet 3 inches
```

Pointers to Structures

https://ideone.com/61hGzX

```
1  #include <stdio.h>
2  #include <string.h>
3
4  struct Books {
5     char  title[60];
6     char  author[50];
7     char  subject[100];
8     int   book_id;
9  };
10
11 /* function declaration */
12 void printBook( struct Books *book );
13
14 int main( ) {
15
16    struct Books Book1;        /* Declare Book1 of type Book */
17    struct Books Book2;        /* Declare Book2 of type Book */
18
```

```
19      /* book 1 specification */
20      strcpy( Book1.title, "The C Programming Language");
21      strcpy( Book1.author, "Brian Kernighan");
22      strcpy( Book1.subject, "Computer Science");
23      Book1.book_id = 1234567;
24
25      /* book 2 specification */
26      strcpy( Book2.title, "Data Structures Algorithms and Applications in C++");
27      strcpy( Book2.author, "Sartaj Sahni");
28      strcpy( Book2.subject, "Computer Science");
29      Book2.book_id = 7654321;
30
```

```
31      /* print Book1 info by passing address of Book1 */
32      printBook( &Book1 );
33
34      /* print Book2 info by passing address of Book2 */
35      printBook( &Book2 );
36
37      return 0;
38  }
39
40  void printBook( struct Books *book ) {
41
42      printf( "Book title : %s\n", book->title);
43      printf( "Book author : %s\n", book->author);
44      printf( "Book subject : %s\n", book->subject);
45      printf( "Book book_id : %d\n\n", book->book_id);
46  }
47
```

Success #stdin #stdout 0.01s 5436KB

```
Book title : The C Programming Language
Book author : Brian Kernighan
Book subject : Computer Science
Book book_id : 1234567

Book title : Data Structures Algorithms and Applications in C++
Book author : Sartaj Sahni
Book subject : Computer Science
Book book_id : 7654321
```

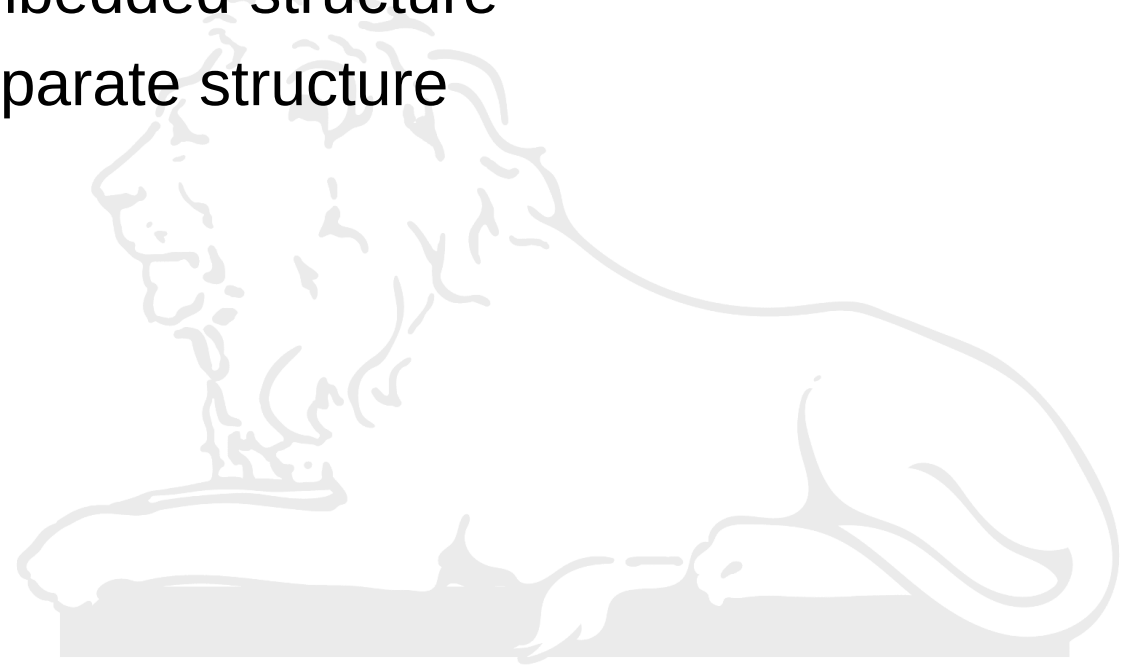
Nested Structure in C

- C provides us the feature of nesting one structure within another structure by using which, complex data types are created.

```
struct address
{
    char city[20];
    int pin;
    char phone[14];
};
struct employee
{
    char name[20];
    struct address add;
};
```

Nested Structure in C

- The structure can be nested in the following ways.
  - By Embedded structure
  - By Separate structure



Embedded structure

```
struct Employee
{
    int id;
    char name[20];
    struct Date
     {
       int dd;
       int mm;
       int yyyy;
     }doj;
}emp1;
```

Embedded structure

```
1   #include <stdio.h>
2   #include <string.h>
3
4   struct Employee
5   {
6       int id;
7       char name[20];
8       struct Date
9        {
10         int dd;
11         int mm;
12         int yyyy;
13       }doj;
14  }e1;
15
```

https://ideone.com/vi7Oi8

Embedded structure

```
16. int main( )
17. {
18.    //storing employee information
19.    e1.id=18;
20.    strcpy(e1.name, "Virat");//copying string into char array
21.    e1.doj.dd=11;
22.    e1.doj.mm=10;
23.    e1.doj.yyyy=2023;
24.
25.    //printing first employee information
26.    printf( "employee id : %d\n", e1.id);
27.    printf( "employee name : %s\n", e1.name);
28.    printf( "employee date of joining (dd/mm/yyyy) : %d/%d/%d\n", e1.doj.dd,e1.doj.mm,
    e1.doj.yyyy);
29.    return 0;
30. }
```

stdout

```
employee id : 18
employee name : Virat
employee date of joining (dd/mm/yyyy) : 11/10/2023
```

Separate structure Example

```
struct Date
{
    int dd;
    int mm;
    int yyyy;
};
struct Employee
{
    int id;
    char name[20];
    struct Date doj;
}emp1;
```

Separate structure

```
1   #include<stdio.h>
2
3   struct address
4   {
5       char city[20];
6       int pin;
7       char phone[14];
8   };
9
10  struct employee
11  {
12      char name[20];
13      struct address add;
14  };
15
```

https://ideone.com/fxcwMt

Separate structure

```
16.  void main ()
17.  {
18.      struct employee emp;
19.      printf("Enter employee information?\n");
20.      scanf("%s %s %d %s",emp.name,emp.add.city, &emp.add.pin, emp.add.phone);
21.      printf("Printing the employee information....\n");
22.      printf("name: %s\nCity: %s\nPincode: %d\nPhone: %s",emp.name,emp.add.city,emp.ad
     d.pin,emp.add.phone);
23.  }
```

stdin

```
Rohit
Nagpur
440001
9876543210
```

stdout

```
Enter employee information?
Printing the employee information....
name: Rohit
City: Nagpur
Pincode: 440001
Phone: 9876543210
```

```
struct employee emp;
printf("Enter employee information?\n");
scanf("%s %s %d %s",emp.name,emp.add.city, &emp.add.pin, emp.add.phone);
printf("Printing the employee information....\n");

printf("name: %s\nCity: %s\nPincode: %d\nPhone: %s",emp.name,emp.add.city,
emp.add.pin,emp.add.phone);
```

Self Referential Structure

```
1   #include <stdio.h>
2   #include <stdlib.h>
3
4   struct Node {
5       int data;
6       struct Node* next;
7   };
8
9   void display(struct Node* temp)
10  {
11      while (temp) {
12      printf(" %d ", temp->data);
13      temp= temp->next;
14      }
15  }
16
```

https://ideone.com/8vguyR

Self Referential Structure

```
17  void main()
18  {
19      // assign each node a null value to avoid any refrence error
20      struct Node* head =NULL;
21      struct Node* second_node = NULL;
22      struct Node* third_node = NULL;
23
24      // defining three nodes
25      head = (struct Node*)malloc(sizeof(struct Node));
26      second_node = (struct Node*)malloc(sizeof(struct Node));
27      third_node = (struct Node*)malloc(sizeof(struct Node));
28
29      head->data = 1000; // assign data in first node
30      head->next = second_node; // Link first node with second
31
32      second_node->data = 2000; // assign data to second node
33      second_node->next = third_node;
```

Self Referential Structure

```
34
35      third_node->data = 3000; // assign data to third node
36      third_node->next = NULL;
37
38      // calling the function to display value
39      display(head);
40
41      free(head);
42      free(second_node);
43      free(third_node);
44  }
45
```

stdout

```
1000   2000   3000
```

Thank You!