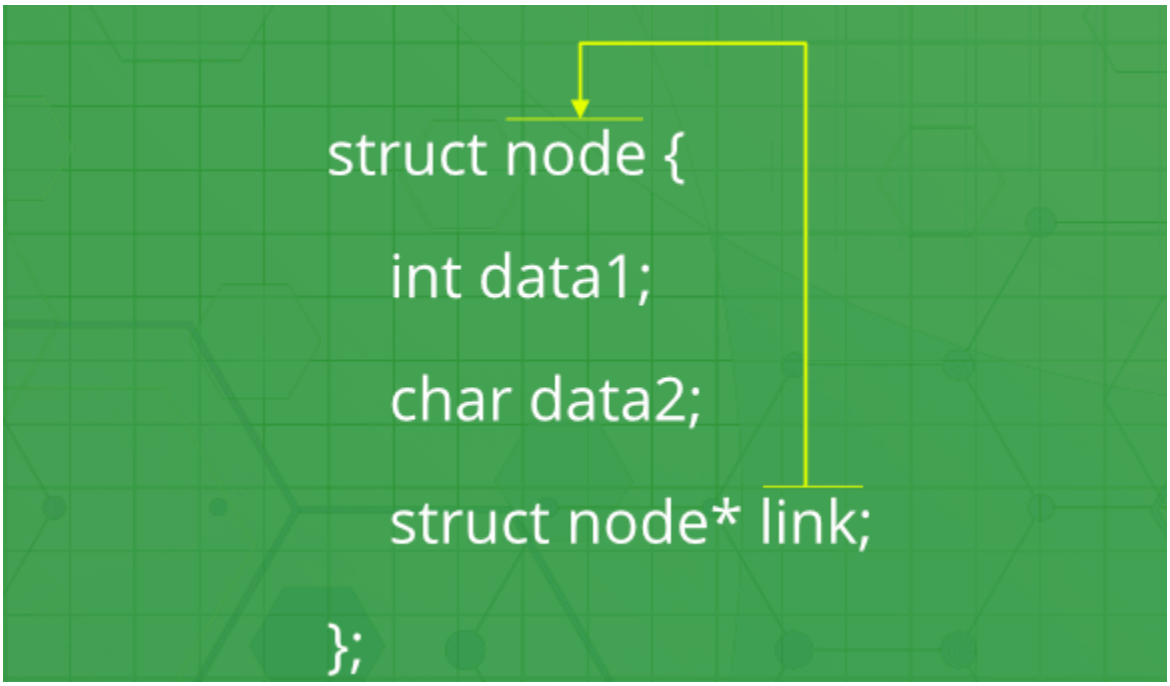
Self-Referential Structures

Self-Referential structures are those structures that have one or more pointers which point to the same type of structure, as their member. In other words, structures pointing to the same type of structures are self-referential in nature.



Example:

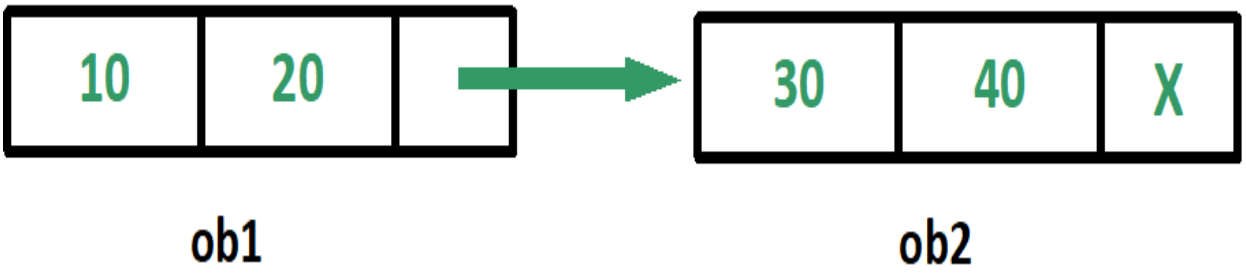
```
struct node {
    int data1;
    char data2;
    struct node* link;
};

int main()
{
    struct node ob;
    return 0;
}
```

In the above example ‘link’ is a pointer to a structure of type ‘node’. Hence, the structure ‘node’ is a self-referential structure with ‘link’ as the referencing pointer. An important point to consider is that the pointer should be initialized properly before accessing, as by default it contains garbage value.

Types of Self Referential Structures

1. Self-Referential Structure with Single Link
2. Self-Referential Structure with Multiple Links

Self-Referential Structure with Single Link: These structures can have only one self-pointer as their member. The following example will show us how to connect the objects of a self-referential structure with the single link and access the corresponding data members. The connection formed is shown in the following figure.

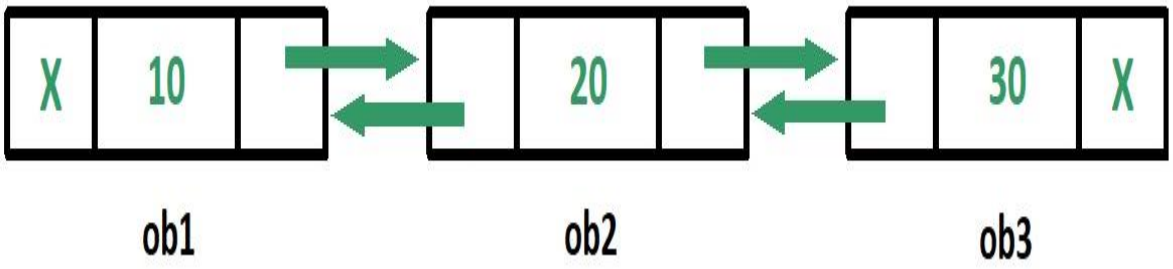



```
#include <stdio.h>
struct node {
    int data1;
    char data2;
    struct node* link;
};

int main()
{
    struct node ob1; // Node1

    // Initialization
    ob1.link = NULL;
    ob1.data1 = 10;
    ob1.data2 = 20;

    struct node ob2; // Node2

    // Initialization
    ob2.link = NULL;
    ob2.data1 = 30;
    ob2.data2 = 40;

    // Linking ob1 and ob2
    ob1.link = &ob2;

    // Accessing data members of  ob2 using ob1
    printf("%d", ob1.link->data1);
    printf("\n%d", ob1.link->data2);
    return 0;
}
```

Output:

```
30

40
```

Self-Referential Structure with Multiple Links: Self-referential structures with multiple links can have more than one self-pointers. Many complicated data structures can be easily constructed using these structures. Such structures can easily connect to more than one nodes at a time. The following example shows one such structure with more than one links.
The connections made in the above example can be understood using the following figure.




```
#include <stdio.h>
struct node {
    int data;
    struct node* prev_link;
    struct node* next_link;
};

int main()
{
    struct node ob1; // Node1

    // Initialization
    ob1.prev_link = NULL;
    ob1.next_link = NULL;
    ob1.data = 10;

    struct node ob2; // Node2

    // Initialization
    ob2.prev_link = NULL;
    ob2.next_link = NULL;
    ob2.data = 20;
```

```
    struct node ob3; // Node3

    // Initialization
    ob3.prev_link = NULL;
    ob3.next_link = NULL;
    ob3.data = 30;

    // Forward links
    ob1.next_link = &ob2;
    ob2.next_link = &ob3;

    // Backward links
    ob2.prev_link = &ob1;
    ob3.prev_link = &ob2;

    // Accessing  data of ob1, ob2 and ob3 by ob1
    printf("%d\t", ob1.data);
    printf("%d\t", ob1.next_link->data);
    printf("%d\n", ob1.next_link->next_link->data);

    // Accessing data of ob1, ob2 and ob3 by ob2
    printf("%d\t", ob2.prev_link->data);
    printf("%d\t", ob2.data);
    printf("%d\n", ob2.next_link->data);

    // Accessing data of ob1, ob2 and ob3 by ob3
    printf("%d\t", ob3.prev_link->prev_link->data);
    printf("%d\t", ob3.prev_link->data);
    printf("%d", ob3.data);
    return 0;
}
```

Output:

```
10    20    30

10    20    30

10    20    30
```