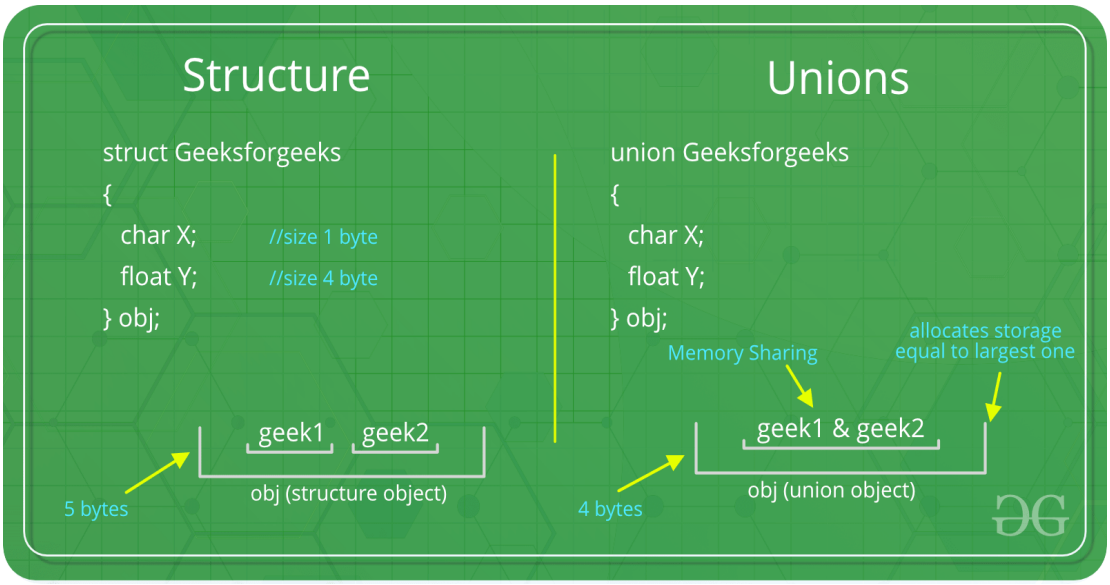
Union

- Like structure, union is a user defined data type. In union, all members share the same memory location.



- A **union** is a special data type available in C that allows to store different data types in the same memory location.
- We can define a union with many members, but only one member can contain a value at any given time.
- Unions provide an efficient way of using the same memory location for multiple purpose.
- To define a union, we must use the **union** statement in the same way as we did while defining a structure.
- The union statement defines a new data type with more than one member for our program.
- **Syntax:**

```
union [union tag]
{
        member definition;
        member definition;
        ...
        member definition;
} [one or more union variables];
```

- **Example:** In the following C program, both x and y share the same location. If we change x, we can see the changes being reflected in y.
  - *Input:*

```
// Declaration of union is same as structures
union test
{
        int x, y;
};

int main()
{
        // A union variable t
        union test t;

         t.x = 2;          // t.y also gets value 2
        printf("After making x = 2:\n x = %d, y = %d\n", t.x, t.y);

         t.y = 10;         // t.x is also updated to 10
          printf("After making y = 10:\n x = %d, y = %d\n", t.x, t.y);
}
```

  - *Output:*

```
After making x = 2:
x = 2, y = 2

After making y = 10:
 x = 10, y = 10
```

- **Size of Union is decided by Compiler**:
  - Size of a union is taken according the size of largest member in union.
  - **Example:**
    - *Input:*

```
union test1
{
        int x;
        int y;
} Test1;
```

```
union test2
{
        int x;
        char y;
} Test2;

union test3
{
        int arr[10];
        char y;
} Test3;

int main()
{
        printf ("sizeof(test1) = %lu\n", sizeof(Test1));
        printf ("sizeof(test2) = %lu\n", sizeof(Test2));
        printf ("sizeof(test3) = %lu\n", sizeof(Test3));
}
```

- **Output:**

```
sizeof(test1) = 4
sizeof(test2) = 4
sizeof(test3) = 40
```

- ## Pointers to Unions:
  - Like structures, we can have pointers to unions and can access members using the arrow operator ***(->)***.
  - **Example:**
    - *Input:*

```
union test
{
        int x;
        char y;
};

int main()
{
        union test p1;
```

```
        p1.x = 65;

        // p2 is a pointer to union p1
        union test* p2 = &p1;

        // Accessing union members using pointer
        printf("%d %c", p2->x, p2->y);
}
```

- *Output:*

```
65 A
```

- **Applications:**
  - Unions can be useful in many situations where we want to use the same memory for two or more members. For example, suppose we want to implement a binary tree data structure where each leaf node has a double data value, while each internal node has pointers to two children, but no data. If we declare this as:

```
struct NODE
{
        struct NODE* left;
        struct NODE* right;
        double data;
};
```

  - Here every node requires 16 bytes, with half the bytes wasted for each type of node. On the other hand, if we declare a node as following, then we can save space.

```
struct NODE
{
        bool is_leaf;
        union
        {
                struct
                {
                        struct NODE* left;
                        struct NODE* right;
                } internal;
                double data;
        } info;
};
```