

Subject Code: CSA105

Two topics have been covered in this document. You will learn about storage classes and basics of array. Few problems are given at the end of this document. You are suggested to implement these problems for better understanding of the concepts.

Topic 1: Storage Classes in C

A storage class defines the scope (visibility) and life-time of variables and/or functions within a C Program. They precede the type that they modify. We have four different storage classes in a C program –

- auto
- register
- static
- extern

The auto Storage Class

The **auto** storage class is the default storage class for all local variables.

```
{  
    int mount;  
    auto int month;  
}
```

The example above defines two variables with in the same storage class. 'auto' can only be used within functions, i.e., local variables.

The register Storage Class

The **register** storage class is used to define local variables that should be stored in a register instead of RAM. This means that the variable has a maximum size equal to the register size (usually one word) and can't have the unary '&' operator applied to it (as it does not have a memory location).

```
{  
    register int miles;  
}
```

The register should only be used for variables that require quick access such as counters. It should also be noted that defining 'register' does not mean that the variable will be stored in a register. It means that it MIGHT be stored in a register depending on hardware and implementation restrictions.

The static Storage Class

The **static** storage class instructs the compiler to keep a local variable in existence during the life-time of the program instead of creating and destroying it each time it comes into and goes out of scope. Therefore, making local variables static allows them to maintain their values between function calls.

The static modifier may also be applied to global variables. When this is done, it causes that variable's scope to be restricted to the file in which it is declared.

In C programming, when **static** is used on a global variable, it causes only one copy of that member to be shared by all the objects of its class.

```
#include <stdio.h>

/* function declaration */
void func(void);

static int count = 5; /* global variable */

main() {

    while(count-->0) {
        func();
    }

    return 0;
}

/* function definition */
void func( void ) {

    static int i = 5; /* local static variable */
    i++;

    printf("i is %d and count is %d\n", i, count);
}
```

When the above code is compiled and executed, it produces the following result –

```
i is 6 and count is 4
i is 7 and count is 3
i is 8 and count is 2
i is 9 and count is 1
```

i is 10 and count is 0

The extern Storage Class

The **extern** storage class is used to give a reference of a global variable that is visible to ALL the program files. When you use 'extern', the variable cannot be initialized however, it points the variable name at a storage location that has been previously defined.

When you have multiple files and you define a global variable or function, which will also be used in other files, then *extern* will be used in another file to provide the reference of defined variable or function. Just for understanding, *extern* is used to declare a global variable or function in another file.

The extern modifier is most commonly used when there are two or more files sharing the same global variables or functions as explained below.

First File: main.c

```
#include <stdio.h>

int count ;
extern void write_extern();

main() {
    count = 5;
    write_extern();
}
```

Second File: support.c

```
#include <stdio.h>

extern int count;

void write_extern(void) {
    printf("count is %d\n", count);
}
```

Here, *extern* is being used to declare *count* in the second file, where as it has its definition in the first file, main.c.

When this program is executed, it produces the following result –

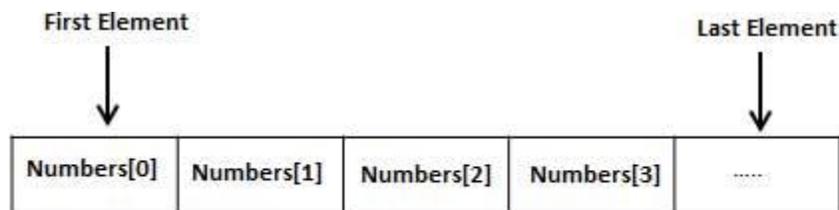
count is 5

Topic 2: Array

Arrays are a kind of data structure that can store a fixed-size sequential collection of elements of the same type. An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.

Instead of declaring individual variables, such as `number0`, `number1`, ..., and `number99`, you declare one array variable such as `numbers` and use `numbers[0]`, `numbers[1]`, and ..., `numbers[99]` to represent individual variables. A specific element in an array is accessed by an index.

All arrays consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.



Declaring Arrays

To declare an array in C, a programmer specifies the type of the elements and the number of elements required by an array as follows –

```
datatype arrayName [ arraySize ];
```

This is called a *single-dimensional* array. The **arraySize** must be an integer constant greater than zero and **datatype** can be any valid C data type. For example, to declare a 10-element array called **balance** of type `double`, use this statement –

```
double balance[10];
```

Here *balance* is a variable array which is sufficient to hold up to 10 double numbers.

Initializing Arrays

You can initialize an array in C either one by one or using a single statement as follows –

```
double balance[5] = { 1000.0, 2.0, 3.4, 7.0, 50.0 };
```

The number of values between braces { } cannot be larger than the number of elements that we declare for the array between square brackets [].

If you omit the size of the array, an array just big enough to hold the initialization is created. Therefore, if you write –

```
double balance[] = { 1000.0, 2.0, 3.4, 7.0, 50.0 };
```

You will create exactly the same array as you did in the previous example. Following is an example to assign a single element of the array –

```
balance[4] = 50.0;
```

The above statement assigns the 5th element in the array with a value of 50.0. All arrays have 0 as the index of their first element which is also called the base index and the last index of an array will be total size of the array minus 1. Shown below is the pictorial representation of the array we discussed above –

	0	1	2	3	4
balance	1000.0	2.0	3.4	7.0	50.0

Accessing Array Elements

An element is accessed by indexing the array name. This is done by placing the index of the element within square brackets after the name of the array. For example –

```
double salary = balance[9];
```

The above statement will take the 10th element from the array and assign the value to salary variable. The following example Shows how to use all the three above mentioned concepts viz. declaration, assignment, and accessing arrays –

```
#include <stdio.h>

int main () {

    int n[ 10 ]; /* n is an array of 10 integers */
    int i,j;

    /* initialize elements of array n to 0 */
    for ( i = 0; i < 10; i++ ) {
        n[ i ] = i + 100; /* set element at location i to i + 100 */
    }

    /* output each array element's value */
    for ( j = 0; j < 10; j++ ) {
        printf("Element[%d] = %d\n", j, n[j] );
    }

    return 0;
}
```

When the above code is compiled and executed, it produces the following result –

```
Element[0] = 100
Element[1] = 101
```

Element[2] = 102
Element[3] = 103
Element[4] = 104
Element[5] = 105
Element[6] = 106
Element[7] = 107
Element[8] = 108
Element[9] = 109

Try yourself :

1. Write a program to find the sum of all elements of an integer array of size 20.
2. Write a program to implement linear search on an array of size 10.
3. Write a program to print the array elements in reverse order.
4. Write a program to print array elements which are even indexed.