STORAGE CLASSES

Fixed vs. Automatic duration

Scope is the technical term that denotes the region of the C source text in which a variable's declaration is active.

Duration describes the **lifetime** of a variable's memory storage.

- Variables with ***fixed duration*** are guaranteed to retain their value even after their scope is exited. Memory for a fixed variable is allocated once and it maintains its memory address.
- There is ***no such guarantee*** for variables with ***automatic duration***. Memory for ***an automatic variable*** is reallocated and reinitialized every time that the declaration takes place

Local variables (whose scope is limited to a block) are automatic by default. However, you can make them fixed by using keyword **static** in the declaration.

The auto keyword explicitly makes a variable automatic, but it is rarely used since it is redundant.

Fixed vs. Automatic duration cont'd

```
void increment ( void )
{
   int j = 1; //automatic duration
   static int k = 1; //fixed duration
   j++;
   k++;
   printf("j : %d\t k:%d\n", j, k);
}
void main ( void )
 {
    increment(); // j : 2      k : 2
    increment(); // j : 2      k : 3
    increment(); // j : 2      k : 4
}
```

Fixed variables initialized ***only once***, whereas automatic variables are initialized ***each time their block is reentered***.

The ***increment()*** function increments two variables, ***j*** and ***k***, both initialized to 1.

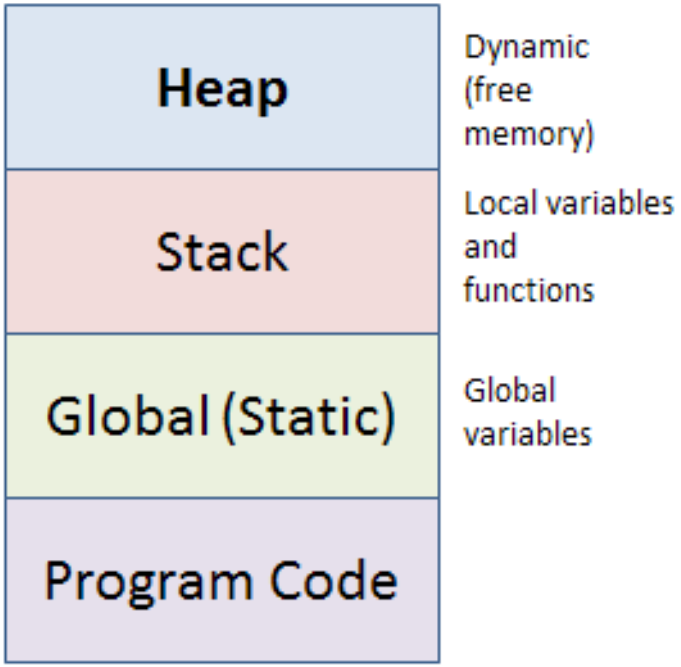
- j has automatic duration by default
- k has fixed duration because of the ***static*** keyword

When increment() is called the second time,

- memory for ***j*** is reallocated and ***j*** is reinitialized to 1.
- k has still maintained its memory address and is **NOT** reinitialized.

Fixed variables get a default initial value of **zero**.

Usage of Memory

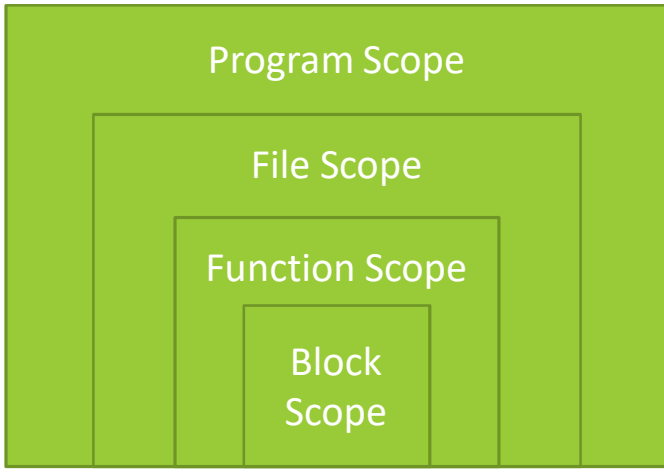


Scope

The scope of a variable determines the region over which you can access the variable by name.

There are four types of scope;

- **Program scope** signifies that the variable is active among different source files that make up the entire executable program. Variables with program scope are often referred as ***global variables***.
- **File scope** signifies that the variable is active from its declaration point to the end of the source file.
- **Function scope** signifies that the name is active from the beginning to the end of the function.
  - The only names that have function scope are ***goto*** labels.
- **Block scope** that the variable is active from its declaration point to the end of the block which it is declared.
  - **A block is any series of statements enclosed in braces.**
  - This includes compound statements as well as function bodies.



scope cont'D

Function scope

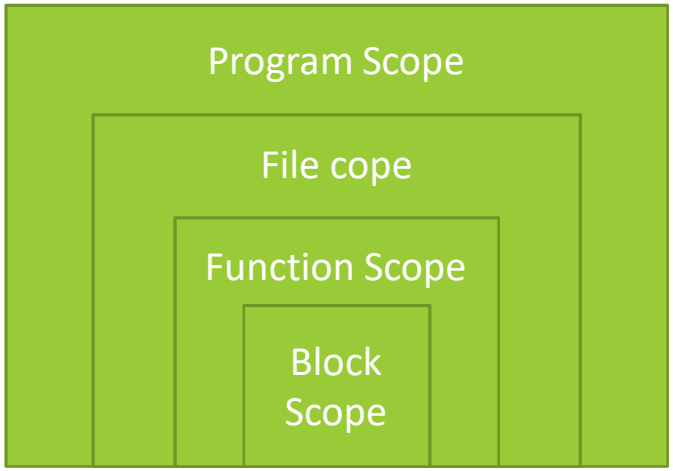
- The only names that have function scope are ***goto*** labels.
- Labels are active from the beginning to the end of a function.
  - This means that labels must be unique within a function
- Different functions may use the same label names without creating conflicts

File & Program scope

- Giving a variable file scope makes the variable active through out the rest of the file.
  - if a file contains more than one function, all of the functions following the declaration are able to use the variable.
  - To give a variable file scope, declare it outside a function with the ***static*** keyword.
- Variable with program scope, called global variables, are visible to routines in other files as well as their own file.
  - To create a global variable, declare it outside a function without ***static*** keyword

Scope cont'D

```
int i=4 ;                    // Global variable, Program Scope
static int j;                // File scope
void func ( int k)           // Block scope
{
        int i,m=1;                  // Block scope
        goto jump;
        m++;
        jump :                      // Function scope
 }
```



Global Variables

In general, you should avoid using global variables as much as possible!

- they make a program harder to maintain, because they increase complexity
- create potential for conflicts between modules
- the only advantage of global variables is that they produce faster code

There are two types of declarations, namely, ***definition and allusion***.

Definations and Allusions

An **allusion** looks just like a definition, but instead of allocating memory for a variable, it informs the compiler that a variable of the specified type exists but is defined elsewhere.

- extern int j;
- The extern keyword tells the compiler that the variables are defined elsewhere.

```
int j=0;                    /* Global defination, fixed duration , program scope*/
void funch()
{
        int k=0;            /* Local defination, automatic duration, block scope*/
        extern int i;       /* Allusion to a global variable*/
}
```

Storage Classes

auto

- superfluous and rarely used.

static

- In declarations within a function, static causes variables to have fixed duration. For variables declared outside a function, the static keyword gives the variable file scope.

extern

- For variables declared within a function, it signifies a global allusion. For declarations outside of a function, extern denotes a global definition.

register

- It makes the variable automatic but also passes a hint to the compiler to store the variable in a register whenever possible.

const

- The const specifier guarantees that you can NOT change the value of the variable.

volatile

- The volatile specifier causes the compiler to turn off certain optimizations. Useful for device registers and other data segments that can change without the compiler's knowledge.

The *register* specifier

The ***register*** keyword enables you to help the compiler by giving it suggestions about which variables should be kept in registers.

- it is only a hint, not a directive, so ***compiler is free to ignore it!***

it is illegal to take address of a register variable.

```
int strlen ( register char *p)  {

        register int len=0;
        while(*p++)  {
                len++;
        }
        return len;
}
```