Data types, Type Qualifiers, storage class specifiers and memory layout

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Modifiers

- It is a keyword in c.
- It specifies the amount of memory space to be allocated for a variable.
- Modifiers are prefixed with basic data types to modify the allocated for a varible.

There are five data type modifiers in c programming language.

- long
- short
- signed
- unsigned
- long long

Basic data type.

Data type determines the type of data a variable will hold.

- char : 1 bytes
- Int : 4 Bytes
- Float : 4 Bytes
- Double : 8 Bytes

Range of n-bit number

- Signed : -2^(n-1) to (n-1) – 1

  eg: for 3 bits -2^(3-1) to 2^(3-1) -1

- Unsigned :0 to 2^(n) – 1

  eg : for 3 bits 0 to 2^(3) -1

Type qualifier

- It is used to indicate special properties of the object being declared.

Type-qualifier :

- const.
- volatile.

Type qualifier may appear with any type specifier.

Type qualifiers

const:

- can be applied to char, int, float, double
- initialized value cannot be modified
- .rodata block
- global const variables
- const applied to local/auto is stored in stack.

Volatile :

- not to optimize code

Type casting

A way to convert a variable from one data type to another data type.

-convert lower data type to higher data type to avoid data loss.

-Data will be truncated when higher data type is converted to lower.

```
#include <stdio.h>

int main ()

{
  int x;

  x = (float)13/7;

  printf("%f", x);

}
```

Storage Class specifiers

1)auto 2)register

3)extern 4)static

Syntax :

storage_class_specifier data_type variable_name;

Storage Class specifiers contd...

1. Automatic Storage Class

```
#include <stdio.h>

int main( )

{

  auto int num_1 = 10;

  {

    auto int num_2= 20;

    {

      auto int num_3 = 30;
```

```
printf ( "%d\t ", num_1);

  }

  printf ( "%d\t ", num_2);

 }

 printf( "%d\t", num_3);

}
```

OUTPUT:

```
10 20 30
```

Storage Class specifiers contd...

2. Register Storage Class

```
#include <stdio.h>

int main()

{
 register int num = 20;

   int *ptr;

   ptr = &num;

   printf("address of num : %u", ptr);

   return 0;

}
```

OUTPUT : ?

Storage class specifiers contd….

file1.c

```
#include<stdio.h>
int var = 10;//global variable
void fun()
{
printf(“%d”, var);
}
```

File2.c

```
#include”file1.c”
void main(void)
{
extern int var;
fun();
}
```

Storage Class specifiers contd…

```
#include <stdio.h>

 extern int x;

  int main()

{

  printf("x:
  %d\n", x);

}

 int x = 10;
```

```
OUTPUT : 10
```

4.static storage class specifiers

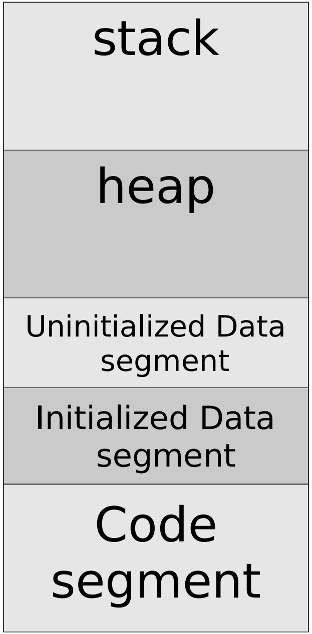
```
#include<stdio.h>

void main(void)

{

 staticfun();

staticfun();

}
```

```
Void staticfun()

{

        static int num;

        {

        static int num = 1;

                printf(“%d”, num);

                Num ++;}

                Printf(“%d\n”, num);

                Num++;}

                Output :

                1 0 2 1
```

Storage Class specifiers contd...

Storage Class Specifier	**Defined/Declared**	**Storage Space**	**Scope**	**Lifetime**
auto	Within a Block/Function	Stack	Block/Function	Within a Block/function
register	Within a Block/Function	Processor Registers	Block/Function	Within a Block/function
static	Within a Block/Function (Function/Block static)	Data Section	Block/Function	Throughout the Program
	Outside Function (File static)	Data Section	All Functions with in a same C file	Throughout the Program
extern	Outside Function	No Storage	All Functions with in a same C file	Throughout the Program

Memory Layout


stack

heap

Uninitialized Data segment

Initialized Data segment

Code segment

```
#include <stdio.h>

char str[ ] = “Global Edge"; /* global variable stored in Initialized Data
                        Segment in read-write area*/

const char str[ ] = “Global"; /* global variable stored in Initialized Data
                        Segment in read-only area*/


char ch; /* Uninitialized variable stored in bss*/  int main()
{
            static  int  num=  2 0 ;  /* static variable stored in Initialized Data
                    Segment*/
    static int num;                          /* Uninitialized static variable stored
            in bss */

    char *ptr= (char*)malloc(sizeof(char)); /* memory allocating in heap
                                                  segment */
    return 0;
}
```

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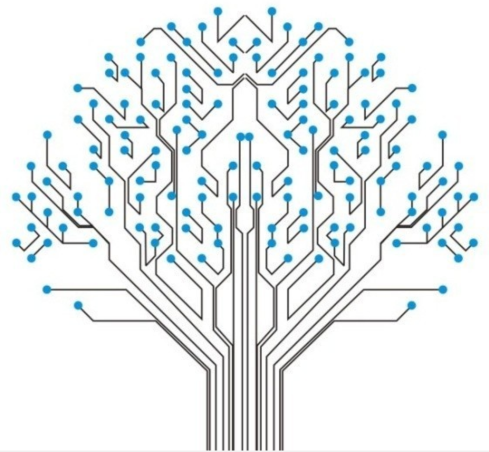

Fairness

Learning

Responsibility

Innovation

Respect