

Dynamic memory allocation in C

The concept of **dynamic memory allocation in c language** enables the C programmer to allocate memory at runtime. Dynamic memory allocation in c language is possible by 4 functions of stdlib.h header file.

1. malloc():allocates single block of requested memory.
2. calloc():allocates multiple block of requested memory.
3. realloc():reallocates the memory occupied by malloc() or calloc() functions.
4. free():frees the dynamically allocated memory.

Static memory allocation vs Dynamic memory allocation

In case of static memory is allocated at compile time. Here memory can't be increased while executing program. It is used in array. Whereas in dynamic memory allocation, the memory is allocated at run time and memory can be increased while executing program. It is generally used in linked list.

malloc() function in C

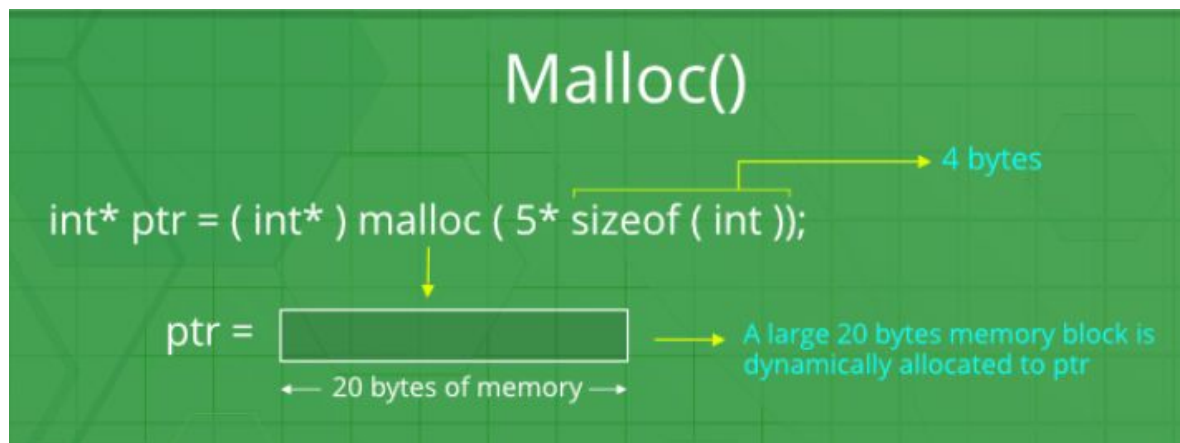
The malloc() function allocates single block of requested memory.

It doesn't initialize memory at execution time, so it has garbage value initially.

It returns NULL if memory is not sufficient.

The syntax of malloc() function is given below:

```
ptr=(cast-type*)malloc(byte-size)
```



```
#include<stdio.h>
#include<stdlib.h>
int main(){
    int n,i,*ptr,sum=0;
    printf("Enter number of elements: ");
    scanf("%d",&n);
```

```

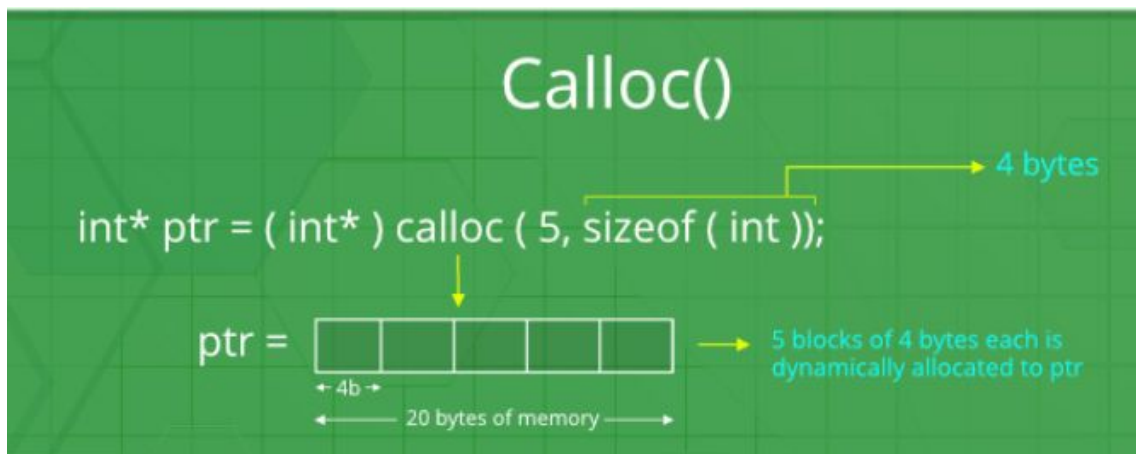
ptr=(int*)malloc(n*sizeof(int)); //memory allocated using malloc
if(ptr==NULL)
{
    printf("Sorry! unable to allocate memory");
    exit(0);
}
printf("Enter elements of array: ");
for(i=0;i<n;++i)
{
    scanf("%d",ptr+i);
    sum+=*(ptr+i);
}
printf("Sum=%d",sum);
free(ptr);
return 0; }

```

calloc() function in C

The calloc() function allocates multiple block of requested memory. It initially initialize all bytes to zero. It returns NULL if memory is not sufficient.

```
ptr=(cast-type*)calloc(number, byte-size)
```



```

#include<stdio.h>
#include<stdlib.h>
int main(){
    int n,i,*ptr,sum=0;
    printf("Enter number of elements: ");
    scanf("%d",&n);
    ptr=(int*)calloc(n,sizeof(int)); //memory allocated using calloc
    if(ptr==NULL)
    {
        printf("Sorry! unable to allocate memory");
        exit(0);
    }
}

```

```

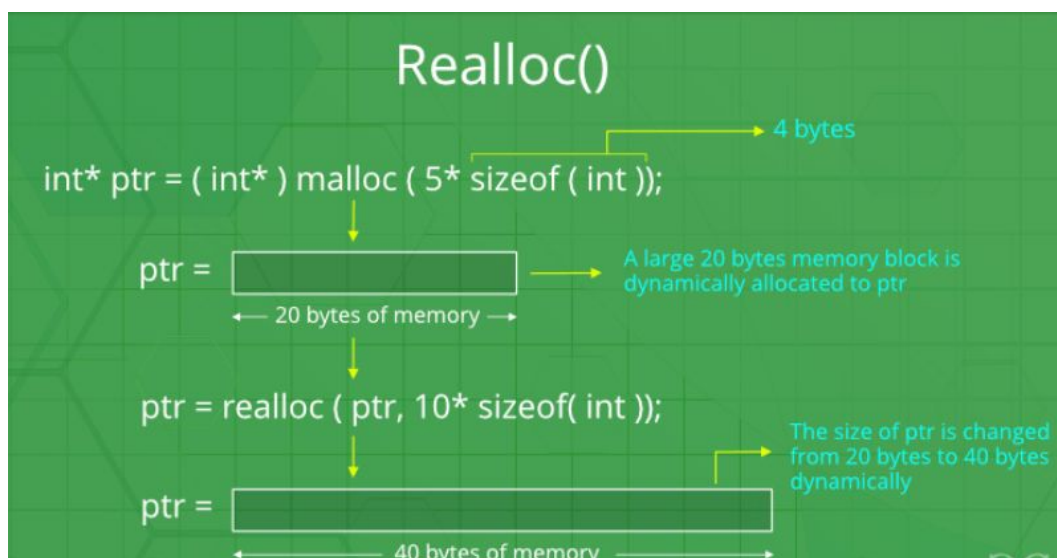
}
printf("Enter elements of array: ");
for(i=0;i<n;++i)
{
    scanf("%d",ptr+i);
    sum+=*(ptr+i);
}
printf("Sum=%d",sum);
free(ptr);
return 0;
}

```

realloc() function in C

If memory is not sufficient for malloc() or calloc(), you can reallocate the memory by realloc() function. In short, it changes the memory size. Let's see the syntax of realloc() function.

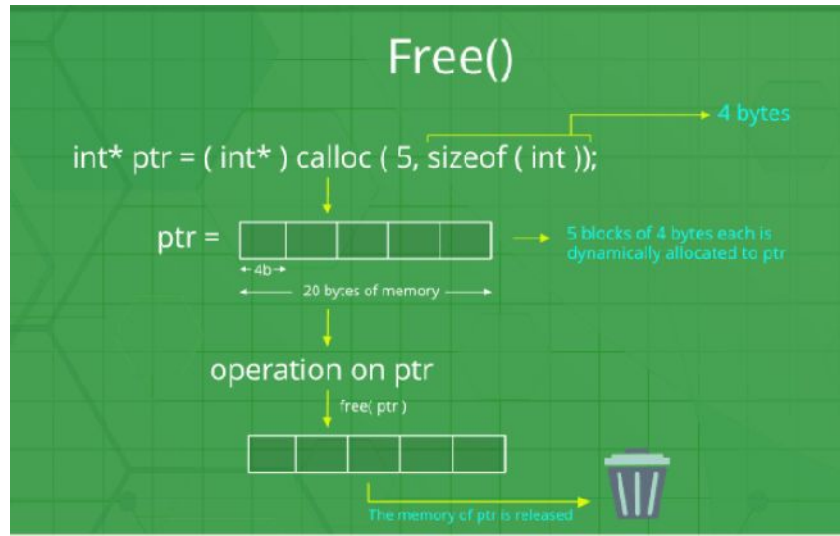
```
ptr=realloc(ptr, new-size)
```



free() function in C

The memory occupied by malloc() or calloc() functions must be released by calling free() function. Otherwise, it will consume memory until program exit. Let's see the syntax of free() function.

```
free(ptr)
```



calloc vs. malloc

The calloc function is generally more suitable and efficient than that of the malloc function. While both the functions are used to allocate memory space, calloc can allocate multiple blocks at a single time. You don't have to request for a memory block every time. The calloc function is used in complex data structures which require larger memory space. The memory block allocated by a calloc function is always initialized to zero while in malloc it always contains a garbage value.

Note:

- We can dynamically manage memory by creating memory blocks as needed in the heap
- In dynamic memory allocation, memory is allocated at a run time.
- Dynamic memory allocation permits to manipulate strings and arrays whose size is flexible and can be changed anytime in your program.
- It is required when you have no idea how much memory a particular structure is going to occupy.
- Malloc is a dynamic memory allocation function which stands for memory allocation that blocks of memory with the specific size initialized to a garbage value
- Calloc is a contiguous memory allocation function that allocates multiple memory blocks at a time initialized to 0
- Realloc is used to reallocate memory according to the specified size.
- Free function is used to clear the dynamically allocated memory.