Dynamic Memory Allocation :

- This procedure is referred to as **Dynamic Memory Allocation in C**.
- Therefore, C **Dynamic Memory Allocation** can be defined as a procedure in which the size of a data structure (like Array) is changed during the runtime.
- C provides some functions to achieve these tasks.
- There are 4 library functions provided by C defined under **<stdlib.h>** header file to facilitate dynamic memory allocation in C programming.

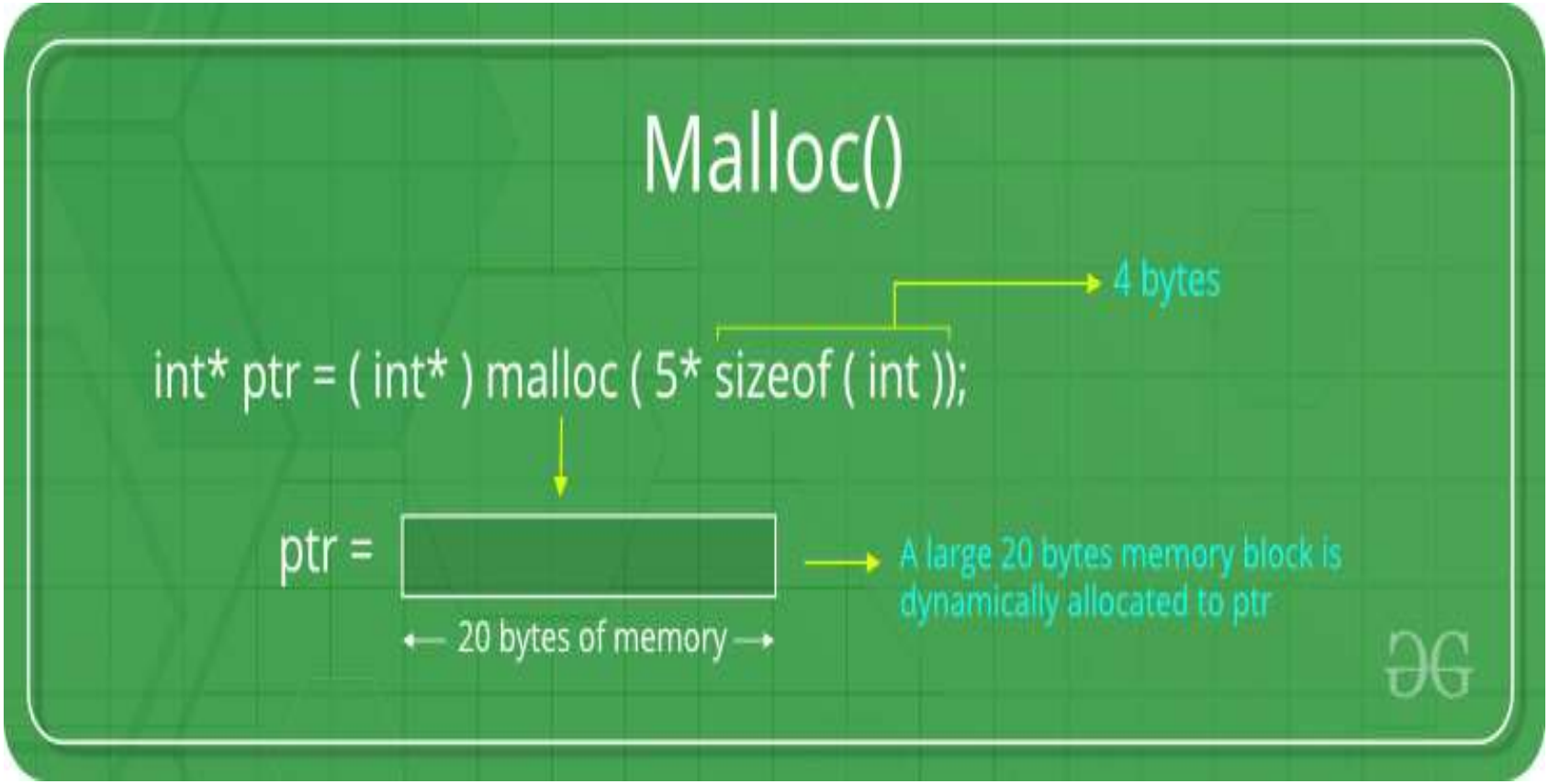
1. malloc()
2. calloc()
3. free()
4. realloc()

1. malloc() :

- The **"malloc"** or **"memory allocation"** method in C is used to dynamically allocate a single large block of memory with the specified size.
- It returns a pointer of type void which can be cast into a pointer of any form.
- It doesn't Initialize memory at execution time so that it has initialized each block with the default garbage value initially.
- **Syntax of malloc() :**

  p = (cast-type*) malloc(byte-size)
- ***p = (int*) malloc(100 * sizeof(int));***

  Since the size of int is 4 bytes, this statement will allocate 400 bytes of memory. And, the pointer ***p*** *holds the address of the first byte in the allocated memory.*


Malloc()
4 bytes
int* ptr = (int*) malloc (5* sizeof (int));
ptr =
A large 20 bytes memory block is dynamically allocated to ptr
20 bytes of memory

```
#include<stdio.h>
#include<stdlib.h>
//#include<alloc.h>
void main() {
   int *p,i,n;
   clrscr();
   printf("Enter Size of dynamic
   array");
   scanf("%d",&n);
   //malloc
p=(int*)malloc(n*sizeof(int));
   //it will allocate dynamic
   memory using malloc() default
   value garbage .
for(i=0;i<n;i++)
{
      printf("\np[%d]",i);
      scanf("%d",&p[i]);
}
for(i=0;i<n;i++)
{
      printf("\n p[%d]%d",i,p[i]);
}
free(p);
getch();
}
```

2. calloc() :

- **“calloc”** or **“contiguous allocation”** method in C is used to dynamically allocate the specified number of blocks of memory of the specified type. it is very much similar to malloc() but has two different points and these are:

1. It initializes each block with a default value ‘0’.
2. It has two parameters or arguments as compare to malloc().

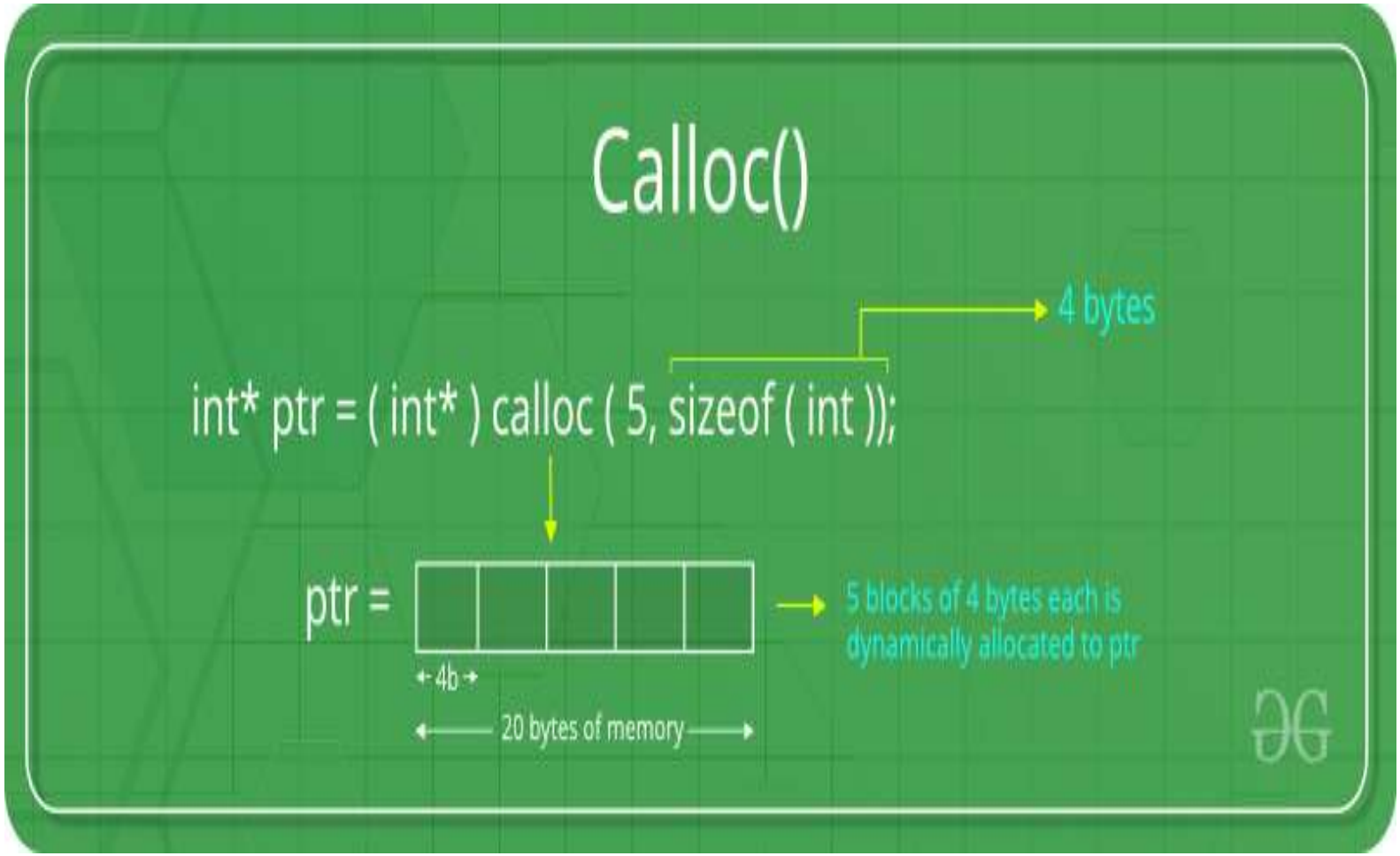
- **Syntax of calloc() :**

  p = (cast-type*)calloc(n, element-size);

  here, n is the no. of elements and element-size is the size of each element.

- ***p = (int*) calloc(25, sizeof(int));***

  This statement allocates contiguous space in memory for 25 elements each with the size of the int.

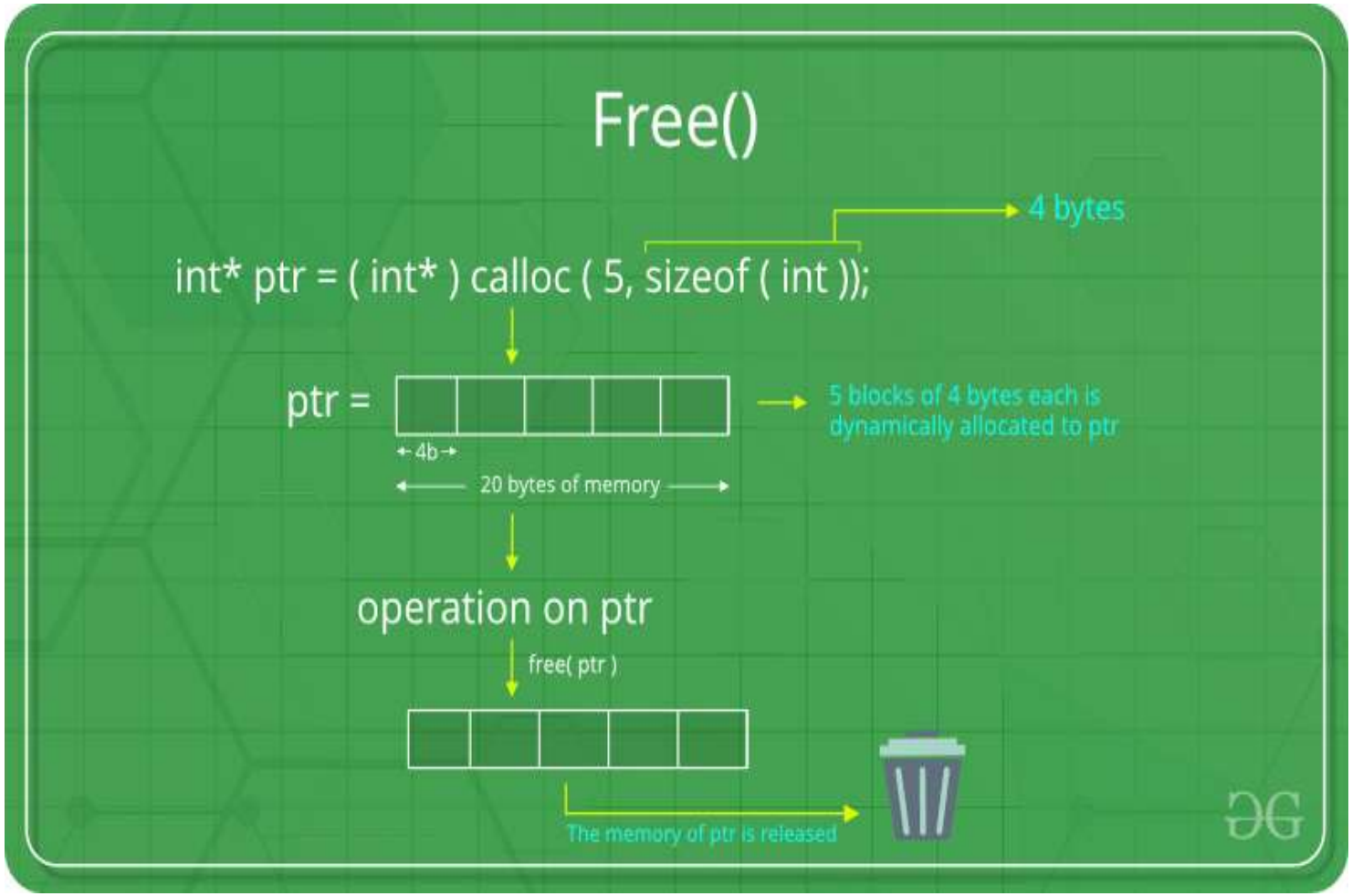

Calloc()
4 bytes
int* ptr = (int*) calloc (5, sizeof (int));
ptr =
5 blocks of 4 bytes each is dynamically allocated to ptr
4b
20 bytes of memory

```
#include<stdio.h>
#include<stdlib.h>
//#include<alloc.h>
void main()  {
   int *p,i,n;
   clrscr();
   printf("Enter Size of dynamic
   array");
   scanf("%d",&n);
p=(int*)calloc(n,sizeof(int));
   //it will allocate dynamic
   memory using calloc(), default
   value 0 .
for(i=0;i<n;i++)
{
      printf("\np[%d]",i);
      scanf("%d",&p[i]);
}
for(i=0;i<n;i++)
{
      printf("\np[%d]%d",i,p[i]);
}
free(p);
getch();
}
```

3. free() :

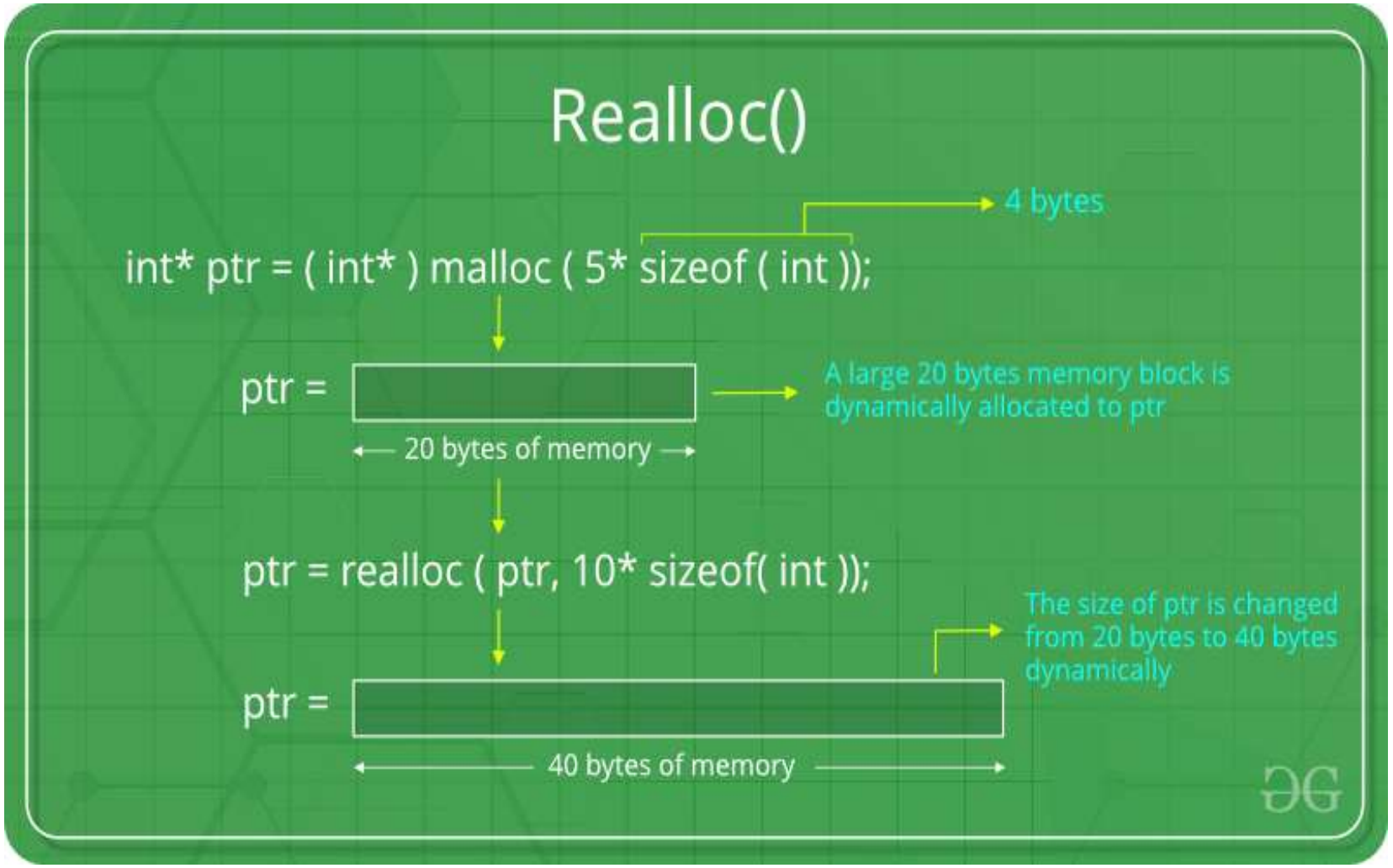
- **"free"** method in C is used to dynamically **de-allocate** the memory.
- The memory allocated using functions malloc() and calloc() is not de-allocated on their own. Hence the free() method is used, whenever the dynamic memory allocation takes place. It helps to reduce wastage of memory by freeing it.
- **Syntax of free() :**

```
free(p);
```


Free()
4 bytes
int* ptr = (int*) calloc (5, sizeof (int));
ptr =
5 blocks of 4 bytes each is dynamically allocated to ptr
4b
20 bytes of memory
operation on ptr
free(ptr)
The memory of ptr is released

4. realloc() :

- **“realloc”** or **“re-allocation”** method in C is used to dynamically change the memory allocation of a previously allocated memory.
- In other words, if the memory previously allocated with the help of malloc or calloc is insufficient, realloc can be used to **dynamically re-allocate memory**.
- re-allocation of memory maintains the already present value and new blocks will be initialized with the default garbage value.
- **Syntax of realloc() :**
- p = realloc(p, newSize);
  where p is reallocated with new size 'newSize'.


Realloc()
4 bytes
int* ptr = (int*) malloc (5* sizeof (int));
ptr =
A large 20 bytes memory block is dynamically allocated to ptr
20 bytes of memory
ptr = realloc (ptr, 10* sizeof(int));
The size of ptr is changed from 20 bytes to 40 bytes dynamically
ptr =
40 bytes of memory

```
#include<stdio.h>
#include<stdlib.h>
void main()  {
    int *p,i,n;
    clrscr();
    printf("Enter Size of dynamic array");
    scanf("%d",&n);
    p=(int*)calloc(n,sizeof(int));
    //it will allocate dynamic memory using calloc(), default value 0 .
    for(i=0;i<n;i++)
    {
            printf("\np[%d]",i);
            scanf("%d",&p[i]);
    }
    for(i=0;i<n;i++)
    {
            printf("\np[%d]%d",i,p[i]);
    }
```

```
//realloc re-allocation of memory
    printf("Enter new Size of dynamic array");
    scanf("%d",&n);
    p=(int *)realloc(p,n*sizeof(int));
    for(i=0;i<n;i++)
    {
            printf("\np[%d]",i);
            scanf("%d",&p[i]);
    }
    for(i=0;i<n;i++)
    {
            printf("\np[%d]%d",i,p[i]);
    }
    free(p);
    getch();
}
```