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POINTERS

Presented by

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Pointer

- A variable that holds a memory address.
- This address is the location of another object in the memory.
- Pointer as an address indicates where to find an object.

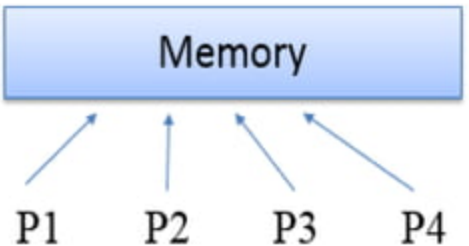
✓ Not all pointers actually contain an address example NULL pointer.

✓ Value of NULL pointer is 0.

- Pointer can have three kinds of content in it
  1) The address of an object, which can be dereferenced.
  2) A NULL pointer.
  3) Invalid content, which does not point to an object.

  (If p does not hold a valid value, it can crash the program)
- If p is a pointer to integer, then
  - Int *p

- ✓ It is possible in some environments to have multiple pointer values with different representations that point to same location in memory.



Different pointers
Holding same address

- ✓ But make sure if the memory is deleted using delete or if original variable goes out of scope.

Declaring pointer

Data-type *name;

- * is a unary operator, also called as indirection operator.
- Data-type is the type of object which the pointer is pointing.
- Any type of pointer can point to anywhere in the memory.
- * is used to declare a pointer and also to dereference a pointer.

- When you write int *, 

  compiler assumes that any address that it holds points to an integer type.

- m= &count;

it means memory address of count variable is stored into m.

& is unary operator that returns the memory address.

i.e. & (orally called as ampersand) is returning the address.

- so it means m receives the address of count.

✓Suppose, count uses memory Address 2000 to store its value 100.

so, m=&count means m has 2000 address.

✓q= *m

it returns the value at address m.

value at address 2000 is 100.

so, q will return value 100.

i.e. q receives the value at address m.

Address-of operator(&)

- It is used to reference the memory address of a variable.
- When we declare a variable, 3 things happen
  - Computer memory is set aside for variable
  - Variable name is linked to that location in memory
  - Value of variable is placed into the memory that was set aside.

- Int *ptr;

  declaring variable ptr which holds the value at address of int type

- int val =1;

  assigning int the literal value of 1

- ptr=&val;

  dereference and get value at address stored in ptr

- int deref =*ptr

  printf("%d\n", deref);

Output will be 1

Pointer Conversions

- One type of pointer can be converted to another type of pointer.
- int main() {

```
double x=100.1, y;
int *p;
p= (int *) &x; //explicit type conversion
y= *p;
}
```

Generic Pointer

- ✓ void * pointer is called as generic pointer.
- ✓ Can't convert void *pointer to another pointer and vice-versa.
- ✓ void *pointer can be assigned to any other type of pointer.
- ✓ void * is used to specify a pointer whose base type is unknown.
- ✓ It is capable of receiving any type of pointer argument without reporting any type of mismatch.

Pointer Arithmetic

- There are only two arithmetic operations that can be used on pointers
  - Addition
  - Subtraction
- To understand this concept, lets p1 be an integer pointer with value 2000 address.
  - int is of 2 bytes
  - After expression p1++;
  - P1 contains address 2002 not 2001.

- Each time p1 is incremented, it will point to next integer.
- The same is true for decrement.
  - for p1--;
  - Causes value of p1 to be 1998.
- Each time a pointer is incremented, it points to the memory location of the next element of its base type.
- If decremented, then it points to previous element location.
- P1=p1+12; makes p1 points to 12^{th} element of p1 type.

Arithmetic Rules

- You cannot multiply or divide pointers.
- You cannot add or subtract two pointers.
- You cannot apply bitwise operators to them.
- You cannot add or subtract type float or double to or from pointers.

Pointer Comparison

- You can compare two pointers in a relational expression, example:

  if(p<q)

  printf("p points to lower memory than q \n");
- Pointer comparison are useful only when two pointers point to a common object such as an array.

Benefits of pointer

- Pointers are used in situations when passing actual values is difficult or not desired.
- To return more than one value from a function.
- They increase the execution speed.
- The pointer are more efficient in handling the data types .
- Pointers reduce the length and complexity of a program.

- The use of a pointer array to character string results in saving of data.
- To allocate memory and access it(Dynamic memory Allocation).
- Implementing linked lists, trees graphs and many other data structure.

How to get address of a function

```
/*A program to get address of a function */
#include<stdio.h>
void main()
 {
   void show();   /*  usual way of invoking a function */
    printf(" The address of show function is=%u", show);
 }
 void show()
 {
    printf(" \welcome to HPES!!")
  }
```

Uses of pointer to function

- Pointers are certainly awkward and off-putting and thus this feature of pointer is used for invoking a function
- There are several possible uses :

(a) In writing memory resident program.

(b) In writing viruses, or vaccines to remove the viruses.

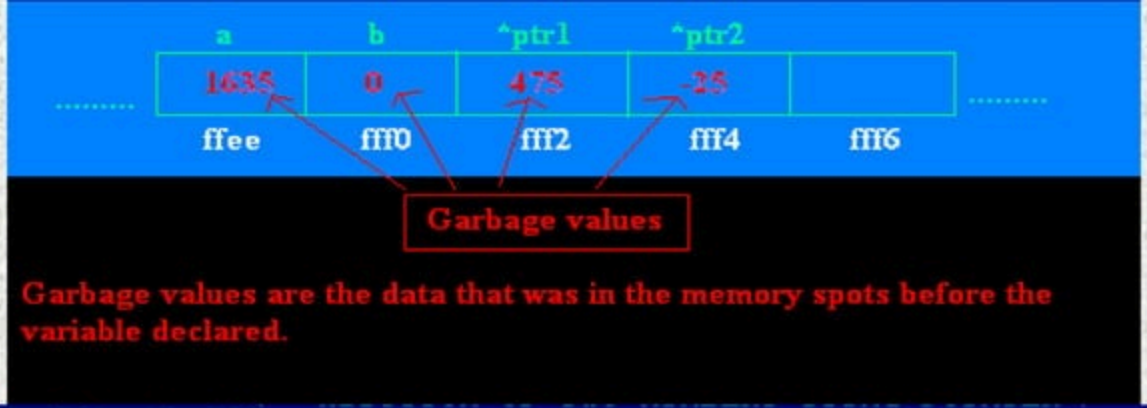
(c) In developing COM/DCOM component

(d) In VC++ programming to connect events to function calls.

```c
#include<conio.h>
#include<stdio.h>
int main()
{
    int *ptr1,*ptr2,a,b;
    clrscr();
    printf("Enter two numbers\n");
    scanf("%d%d",&a,&b);
    printf("Given numbers are %d and %d\n",a,b);
    ptr1=&a;
    ptr2=&b;
    printf("Adress of a is %x and that of b is %x\n",ptr1,ptr2);
    printf("Sum of %d and %d is %d\n",a,b,*ptr1+*ptr2);
    getch();
    return 0;
}
```

Variable name ------>

Address ------------>

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#include<stdio.h>
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{
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    printf("Enter two numbers\n");
    scanf("%d%d",&a,&b);
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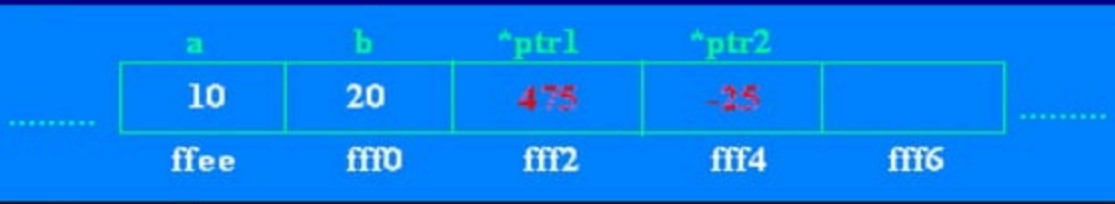
}
```




```
Enter two numbers
10
20
```

```c
#include<conio.h>
#include<stdio.h>
int main()
{
    int *ptr1,*ptr2,a,b;
    clrscr();
    printf("Enter two numbers\n");
    scanf("%d%d",&a,&b);
    printf("Given numbers are %d and %d\n",a,b);
    ptr1=&a;
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    printf("Adress of a is %x and that of b is %x\n",ptr1,ptr2);
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    getch();
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}
```

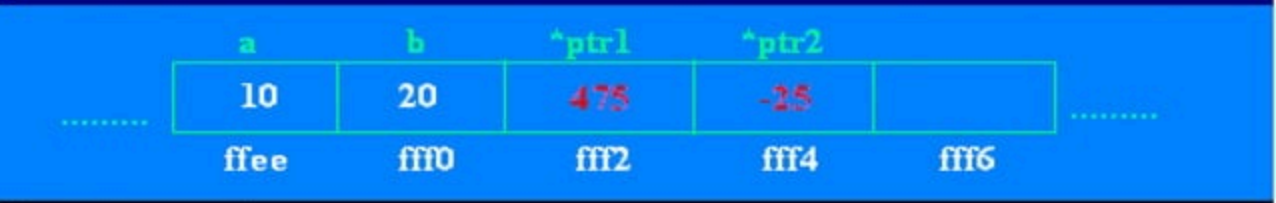


```
Enter two numbers
10
20
Given numbers are 10 and 20
```

```c
#include<conio.h>
#include<stdio.h>
int main()
{
    int *ptr1,*ptr2,a,b;
    clrscr();
    printf("Enter two numbers\n");
    scanf("%d%d",&a,&b);
    printf("Given numbers are %d and %d\n",a,b);
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}
```

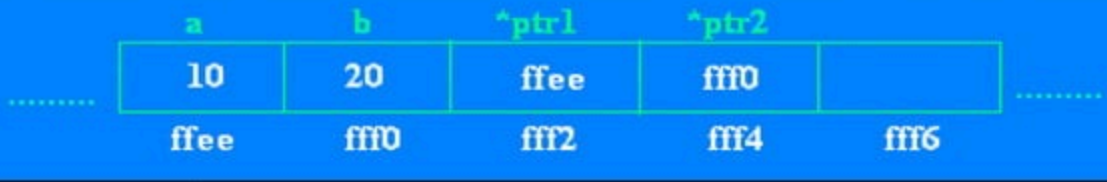


```
Enter two numbers
10
20
Given numbers are 10 and 20
```

```c
#include<conio.h>
#include<stdio.h>
int main()
{
    int *ptr1,*ptr2,a,b;
    clrscr();
    printf("Enter two numbers\n");
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    printf("Adress of a is %x and that of b is %x\n",ptr1,ptr2);
    printf("Sum of %d and %d is %d\n",a,b,*ptr1+*ptr2);
    getch();
    return 0;
}
```


```
Enter two numbers
10
20
Given numbers are 10 and 20
Address of a is ffee and that of b is fff0
Sum of 10 and 20 is 30
```

Thank you