UNIT 9
POINTERS

LH - 6HRS

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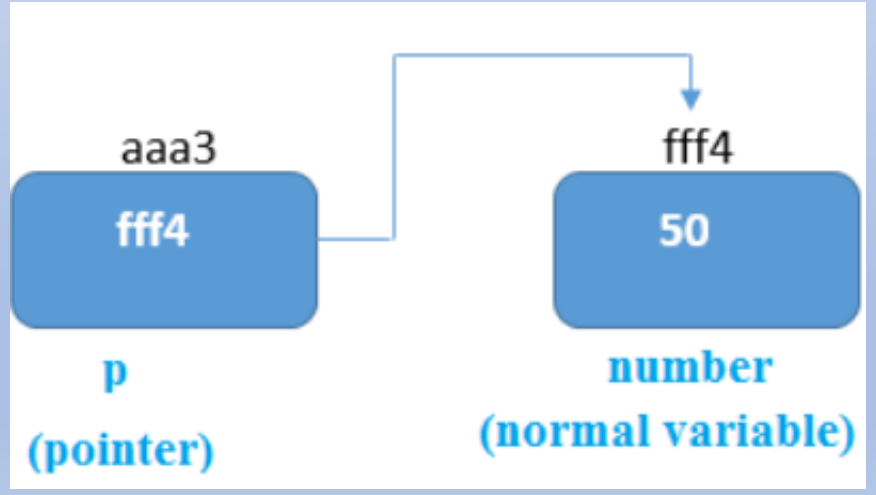
CONTENTS (LH - 6HRS)

9.1 Introduction

- A pointer is a variable whose value is the address of another variable, i.e., direct address of the memory location.
- Like any variable or constant, one must declare a pointer before using it to store any variable address.



9.2 Declaration and Initialization of Pointer Variables

- The general form of a pointer variable declaration is −

type *var-name;

- Here, **type** is the pointer's **base type**; it must be a valid **C data type** and **var-name** is the **name of the pointer variable**. The **asterisk *** used to declare a pointer is the same asterisk used for multiplication. However, in this statement the asterisk is being used to designate a variable as a pointer. Take a look at some of the valid pointer declarations −

```
int    *ip;    /* pointer to an integer */
double *dp;    /* pointer to a double */
float  *fp;    /* pointer to a float */
char   *ch;    /* pointer to a character */
```

LAB 1: WAP for illustrating use of pointers.

```
#include<stdio.h>
int main(){
        int x=10, *p=&x;
        printf("The value of x=%d",x);
        printf("\nThe address of x=%u",p);
        printf("\nThe value of x=%d",*p);//* is indirection or dereference operator
return 0;
}
```

```
The value of x=10
The address of x=6684180
The value of x=10
```

9.3 Array of Pointers

- A pointer variable always contains an address of a variable. So, **an array of pointers is actually an array of memory addresses of different variables**.

Syntax: data_type *pointer_name[size];

Example: int *p[5];

LAB 2: WAP for illustrating use of array of pointers.

```
#include<stdio.h>
int main(){
        int a[5]={10,20,30,40,50};
        int *p[5];
        for(int i=0;i<5;i++){
                p[i]=&a[i];//store address of array element
                printf("Address=%u\n",p[i]);
        }
        return 0;
}
```

```
Address=6684160
Address=6684164
Address=6684168
Address=6684172
Address=6684176
```

9.4 Passing Pointers to Functions

- A pointer can be passed to a function as an argument.
- **Passing a pointer means passing address of a variable** instead of value of the variable.
- As address is passed in this case, **this mechanism is also called call by address or call by reference. (already done in previous unit)**
- Example for this topic: Call by reference/address done in user-defined function.

9.5 Pointers and Arrays

1-D Array and Pointer

- **Array name by itself is an address or pointer** which **points to the first or 0^{th} element of the array**(called base address).
- **Address of first array element** can be expressed as **either &a[0] or a.** Similarly **address of second array element** can be written as either **&a[1] or a+1** and so on.
- **Value of first array element** can be expressed as **either a[0] or *a** and **value of second array elemen**t can be expressed as **either a[1] or *(a+1)** and so on.

LAB 3: WAP to demonstrate the relationship between arrays and pointer.

```
#include<stdio.h>
int main(){
        int a[5]={1,2,3,4,5};
        int *p=a;       //p is assigned the address of 1st element
        for(int i=0;i<5;i++){
                printf("%d\n",*p);
                p++;    // move the p pointer to the next memory location
        for(int i=0;i<5;i++){
                printf("%u\n",p);
                p++;
        }
        return 0;
}
```

```
1
2
3
4
5
6684144
6684148
6684152
6684156
6684160
```

9.6 String and Pointer

LAB 4: WAP that demonstrate the relationship between string and pointer.

```
#include <stdio.h>
int main() {
        char str[6] = "Hello"; // string variable-Hello\0
        char *ptr = str; // pointer variable
         // print the string
         while(*ptr != '\0') {
                printf("%c", *ptr);
                ptr++;// move the ptr pointer to the next memory location
        }
  return 0;
}
```

9.7 Dynamic Memory Allocation

- The process of allocating and freeing memory at run time is known as Dynamic Memory Allocation.
- There are four library functions malloc(), calloc(), free() and realloc() for memory management.

1. **malloc() function: (memory allocation)**

Syntax: ptr = (data_type*)malloc(size_of_block);

Example: ptr = (int*)malloc(100*sizeof(int));

2. **calloc() function: (contiguous allocation)**

Syntax: ptr = (data_type*)calloc(no_of_blocks, size_of_each_block));

Example: ptr = (int*)calloc(100, sizeof(int));

3. free() function:

Dynamically allocated memory is deallocated with the free function.

Example: free(ptr);

4. realloc() function:

Syntax:

ptr = malloc(size);

ptr = realloc(ptr, newsize);

Lab 5: WAP to read an array of integers using DMA and display minimum and maximum value.

```
#include<stdio.h>
#include<stdlib.h>
int main(){
        int n,i,min,max;
        int *ptr;
        printf("Enter the size of block:");
        scanf("%d",&n);
        ptr=(int*)calloc(n,sizeof(int));
        printf("Enter elements of array:");
        for(i=0; i<n; i++){
                scanf("%d",ptr+i);
        }
        min=*ptr;
        max=*ptr;
        for(i=1;i<n;i++){
                if(min>*(ptr+i)){
                        min=*(ptr+i);
                }
                if(max<*(ptr+i)){
                        max=*(ptr+i);
                }
        }
        printf("The minimum value is: %d",min);
        printf("\nThe maximum value is: %d",max);
        return 0;
}
```

```
Enter the size of block:5
Enter elements of array:20
30
10
50
40
The minimum value is: 10
The maximum value is: 50
```

THANK YOU FOR YOUR ATTENTION

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