# Paper 102: Programming & Problem solving through C

## Lecture-17:Unit-II Pointers

# More on Pointers

- Pointers store the address of another variable
- Pointers can be declared as follows
  - int *p;
  - char *p;
  - float *p;
  - double *p;
- The pointer p can store addresses of integer variable, character variable, float variable or double variable depending on how it was declared.
- Address can be assigned to it as follows
  - p=&a;
- Value of a can be access using *p (indirection operator)

# void pointers

- Pointers are defined to be a specific data type
- It cannot hold the address of any other type of variable.
- It is incorrect to use

```
int *f;
float a;
f=&a;
```

- This restriction can be overcome by using a void pointer

# Cont…void pointers

- A void pointer is a general purpose pointer.
- It can be declared as

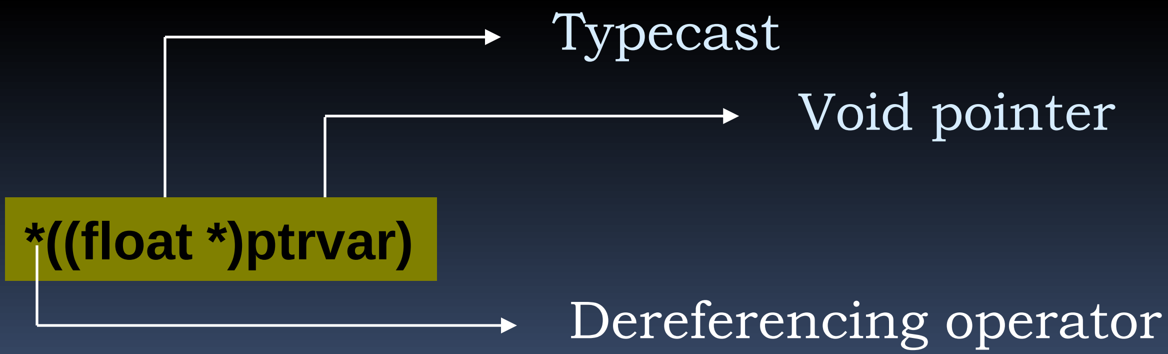
```
void *ptr;
```

- Pointers declared in this manner can store the address of any type of variables

```
ptr=&intvar;
ptr=&floatvar;
ptr=&doublevar;
ptr=&charvar;
```

# Cont…void pointers

- Pointers to void cannot be directly dereference like other pointer variables by using the indirection operator *
- Before dereferencing, a pointer to void must be suitably *typecast* to the required data type



Typecast

Void pointer

`*((float *)ptrvar)`

Dereferencing operator

# Example

```
#include <stdio.h>

void main(void)
{
  void *ptr;
  int a=5;
  float p=3.14;

  ptr=&p;
  printf("Value of Pi is=%f", *((float *)ptr));
  ptr=&a;
  printf("Value of a is=%d", *((int *)ptr));

  getch();
}
```

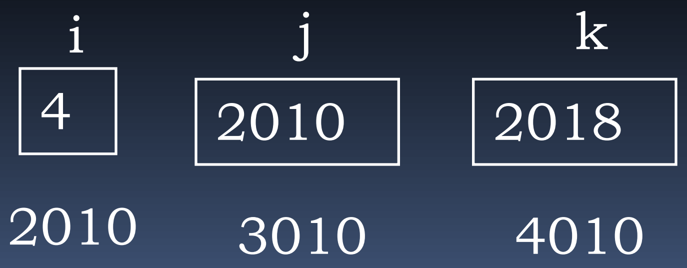
# Near and far pointers

- Pointers that can access only address within the same segment would store only the offset in that segment
  - Near pointers
- Pointers that can store both segment and offset can access  addresses of a different segment.
  - Far pointers

# Pointer Arithmetic

- Addition of a number to a pointer

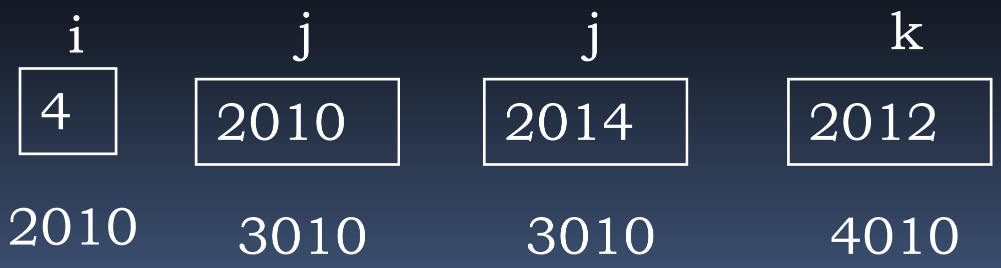
```
int i=4,*j,*k;
j=&I;
j=j+1;
k=j+3;
```



# Pointer Arithmetic

- Subtraction of a number from a pointer

```
int i=4,*j,*k;
j=&i;
j=j+2;
k=j-1;
```

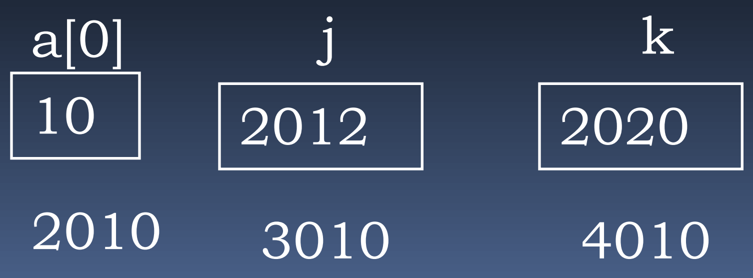


| i | j | j | k |
|---|---|---|---|
| 4 | 2010 | 2014 | 2012 |
| 2010 | 3010 | 3010 | 4010 |

# Pointer Arithmetic

- Subtraction of a pointer from another
  - Possible only if both pointers point to elements of the same array
  - The result is the number of elements separating the corresponding array elements

```
int a[]=(10,20,30,40,50,60,70};
int *j,*k;
j=&a[1];
k=&a[5];
printf("%d %d",j-k,*j-*k);
```



# Pointer Arithmetic

- Comparison of two pointer variables
  - Possible only if both pointers point to objects of the same data type
  - Usually done testing of equality or inequality

```
int a[]=(10,20,30,40,50,60,70};
int *j,*k;
j=&a[1];
k=(a+1);
if (j==k) printf(“pointing to same location”);
else printf(“not pointing to same location”);
```

# Pointer Arithmetic

- Invalid operations
  - Addition of two pointers
  - Multiplication of a pointer with a constant
  - Division of a pointer with a constant

# Pointers and Arrays

```
//dynamic 1-d array
#include<stdio.h>
void main()
{
        int *n,size,i;
        clrscr();
        printf("\nHow many elements:");
        scanf("%d",&size);
        n=(int *)malloc(size * sizeof(int));
        for(i=0;i<size;i++)
        {printf("\n enter a number:");
        scanf("%d",(n+i));
        }
        printf("\n the output is:\n");
        for(i=0;i<size;i++)
        {
                printf("%d\t",*(n+i));
        }
        getch();
}
```

# Pointers and Arrays -cont..

```
//an array of pointers
#include<stdio.h>
#define MAXR 10
void inputdata(int *n[MAXR],int r, int c);
void main()
{
        int *b[MAXR];
        int r,c,i,j;
        clrscr();
        printf("\n how many rows?");
        scanf("%d",&r);
        printf("\n how many cols?");
        scanf("%d",&c);
        for(i=0;i<r;i++)
                b[i]=(int *) malloc(c * sizeof(int));
        printf("\n input data");
        inputdata(b,r,c);

        printf("\n b array\n");
        for(i=0;i<r;i++)
        {
                for(j=0;j<c;j++)
                {
                        printf("%d\t",*(*(b+i) + j));
                }
                printf("\n");
        }
        getch();
}
```

# An array of pointers

```
void inputdata(int *n[MAXR],int
r,int c)
{
    int i,j;
    for(i=0;i<r;i++)
    {
      for(j=0;j<c;j++)
      {
                printf("\nenter number:");
                scanf("%d",(*(n+i)+j));
        }
     }
}
```

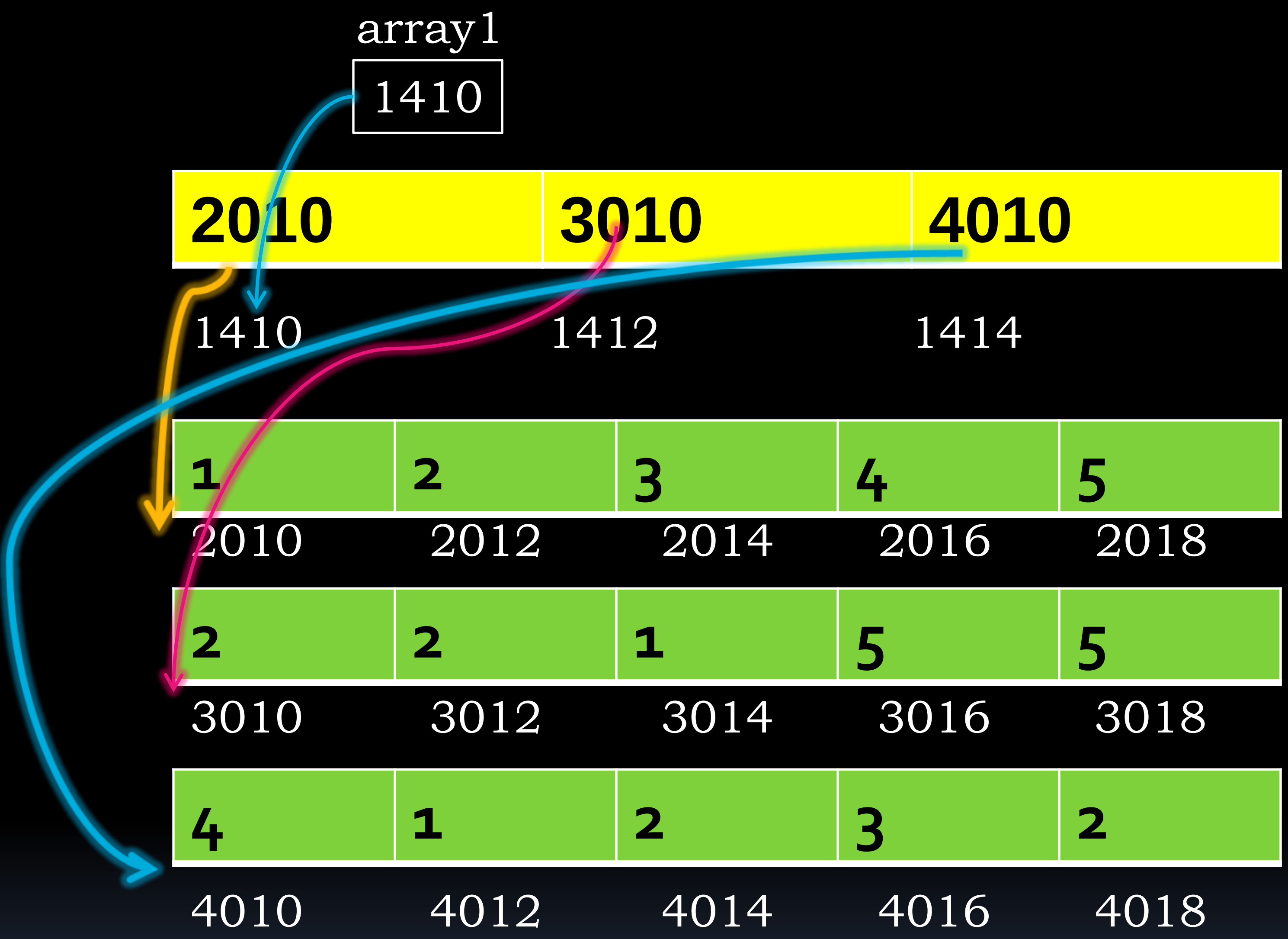
# Creating a 2-d array Dynamically

```
#include<stdio.h>
void main()
{
            int **array1;
            int nrows,ncols,i,j;
            clrscr();
            printf("\n enter the rows:");
            scanf("%d",&nrows);
            printf("\n enter the cols:");
            scanf("%d",&ncols);
 //  Allocate an array of pointers.
 //  Then initialize each pointer to a dynamically
 //  allocated row.
 array1 = (int **) malloc( nrows * sizeof(int*));
 if( array1 == NULL){
            printf("Out of memory");
 }
 for(i = 0; i < nrows; i++){
            array1[i] = (int * )malloc(ncols * sizeof(int));
 }
```

# Creating a 2-d array Dynamically

```
for (i=0; i<nrows; i++){
            for (j=0;j<ncols;j++)
   {                      printf("\n enter a number:");
                          scanf("%d",&array1[i][j]);
            }
   }
   for (i=0; i<nrows; i++){
            for (j=0;j<ncols;j++)
                          printf("%8d",array1[i][j]);
                          printf("\n");

            }
  }
```



array1

1410

| | | |
|---|---|---|
| 2010 | 3010 | 4010 |
| 1410 | 1412 | 1414 |

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 2010 | 2012 | 2014 | 2016 | 2018 |
| 2 | 2 | 1 | 5 | 5 |
| 3010 | 3012 | 3014 | 3016 | 3018 |
| 4 | 1 | 2 | 3 | 2 |
| 4010 | 4012 | 4014 | 4016 | 4018 |

**//using command line arguments**

```
#include<stdio.h>
#include<string.h>
void main(int argc,char *argv[])
{
        int i,j;
        if(argc==1)
                exit();
        printf("number of arguments=%d",argc);
        for(i=0;i<argc;i++)
        {       puts(argv[i]);
                printf("%d",strlen(argv[i]));

        }


}
```

1. **argc is the total number of arguments**
2. ***argv[] is an array of strings, storing the list of arguments including the program name**
3. **To run create an exe file and execute from the dos prompt:**

   **D:\>cmdline *argument1 argument2***

# Class Assignment

- Create an array to store the marks of a list of students in three subjects. Write a program to find the average of marks of each student, and display the Top Five students based on their average marks. Use Dynamic arrays.
- Write a program to display the Calendar of any Month in a particular Year.