# Arrays – Q1

(**reverseAr1D**) Write a C function printReverse() that prints an array of integers in reverse order. For example, if ar[5] = {1,2,3,4,5}, then the output 5, 4, 3, 2, 1 will be printed after applying the function printReverse(). The function prototype is given as follows:

**void printReverse(int ar[ ], int size);**

where *size* indicates the size of the array.

Write two versions of printReverse().

(1)One version printReverse1() uses index notation.

(2)The other version printReverse2() uses pointer notation for accessing the element of each index location.

In addition, write another C function **reverseAr1D()** that takes in an array of integers **ar** and a parameter **size** that indicates the size of the array to be processed. The function converts the content in the array in reverse order and passes the array to the calling function via call by reference.

**void reverseAr1D(int ar[ ], int size);**

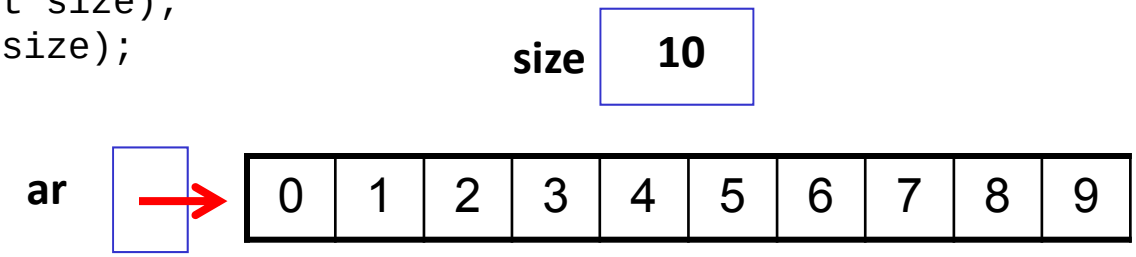
Write a C program to test the functions.

**Sample input and output session:**

```
Enter array size:
5
Enter 5 data:
1 2 3 6 7
printReverse1(): 7 6 3 2 1
printReverse2(): 7 6 3 2 1
reverseAr1D(): 7 6 3 2 1
```

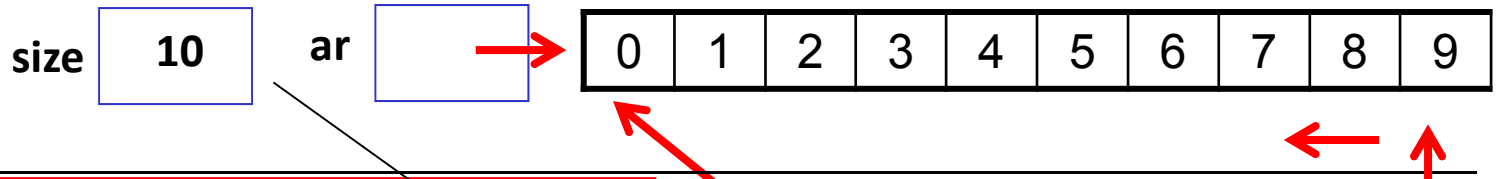
# Arrays – Q1

```
#include <stdio.h>
int readArray(int ar[ ]);
void printReverse1(int ar[ ], int size);
void printReverse2(int ar[ ], int size);
void reverseAr1D(int ar[ ], int size);
int main(){
    int ar[10];
    int size, i;

    printf("Enter array size: \n");
    scanf("%d", &size);
    printf("Enter %d array: \n", size);
    for (i=0; i <= size-1; i++)
        scanf("%d", &ar[i]);

    printReverse1(ar, size);
     printReverse2(ar, size);

    reverseAr1D(ar, size);
     printf("reverseAr1D(): ");
     if (size > 0) {
        for (i=0; i<size; i++)
            printf("%d ", ar[i]);
     }
    return 0;
}
```

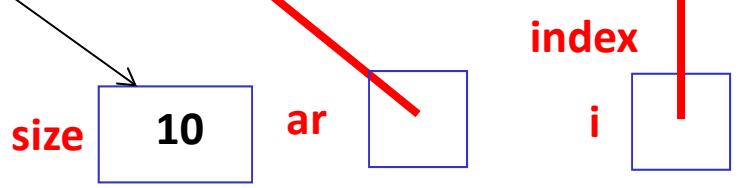


# Arrays – Q1

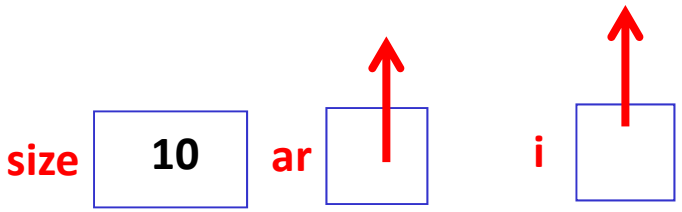
```
int main(){

}
```



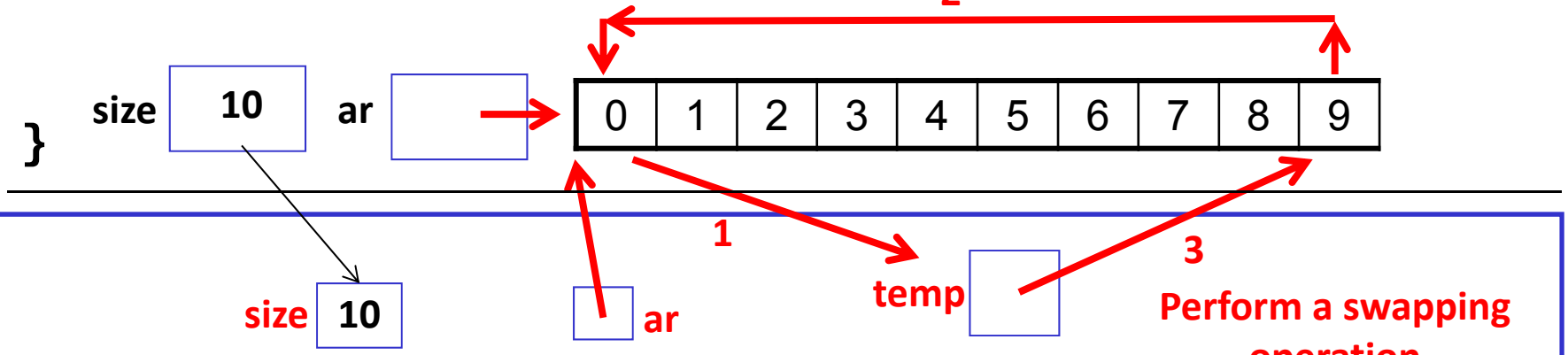

```
void printReverse1(int ar[ ], int
size){
   int i;
   printf("printReverse1(): ");
   if (size > 0) {
      for (i=size-1; i>=0; i--)
         printf("%d ", ar[i]);
   }
   printf("\n");
}
```




```
void printReverse2(int ar[ ], int
size){
   int i;
   printf("printReverse2(): ");
   if (size > 0) {
      for (i=size-1; i>=0; i--)
         printf("%d ", *(ar+i));
   }
   printf("\n");
}
```



# Arrays – Q1




```
/* reverseAr1D reverses the array contents and passes
that back to the calling function */

void reverseAr1D(int ar[ ], int size){
   int i, temp;
   if (size > 0) {
      for (i=0; i < size/2; i++){
         temp = ar[i];
         ar[i] = ar[size-i-1];
         ar[size-i-1] = temp;
      }
   }
}
```

**Using Call by Reference**
**- No return statement**

# Arrays – Q2

**(swap2RowsCols2D)** Write the code for the following functions:

**void swap2Rows(int M[SIZE][SIZE], int r1, int r2);**

/* the function swaps the row r1 with the row r2 */

**void swap2Cols(int M[SIZE][SIZE], int c1, int c2);**

/* the function swaps the column c1 with the column c2 */

Write a C program to test the above functions. In addition, your program should print the resultant matrix after each operation. You may assume that the input matrix is a 3x3 matrix when testing the functions.

**Sample input and output :**

Enter the matrix (3x3):
***5 10 15***
***15 20 25***
***25 30 35***

**Enter two rows for swapping:**

***1 2***

The new array is:
5 10 15
25 30 35
15 20 25

**Enter two columns for swapping:**

***1 2***

The new array is:
5 15 10
25 35 30
15 25 20

# Arrays – Q2

```
#include <stdio.h>
#define SIZE 3
void swap2Rows(int ar[][SIZE], int r1, int r2);
void swap2Cols(int ar[][SIZE], int c1, int c2);
void display(int ar[][SIZE]);
int main()
{
   int array[SIZE][SIZE];
   int row1, row2, col1, col2;
   int i,j;
   int choice;

   printf("Select one of the following options: \n");
   printf("1: getInput()\n");
   printf("2: swap2Rows()\n");
   printf("3: swap2Cols()\n");
   printf("4: display()\n");
   printf("5: exit()\n");
   do {
      printf("Enter your choice: \n");
      scanf("%d", &choice);
      switch (choice) {
         case 1:
            printf("Enter the matrix (3x3): \n");
            for (i=0; i<SIZE; i++)
                 for (j=0; j<SIZE; j++)
                    scanf("%d", &array[i][j]);
            break;
```

Enter the matrix (3x3):

***5 10 15***

***15 20 25***

***25 30 35***

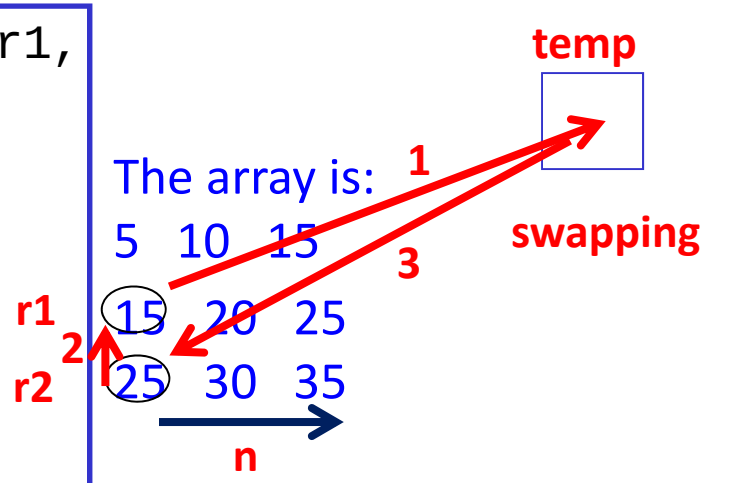
# Arrays – Q2

```
        case 2:
           printf("Enter two rows for swapping: \n");
           scanf("%d %d", &row1, &row2);
           swap2Rows(array, row1, row2);
           printf("The new array is: \n");
           display(array);
           break;
        case 3:
           printf("Enter two columns for swapping: \n");
           scanf("%d %d", &col1, &col2);
           swap2Cols(array, col1, col2);
           printf("The new array is: \n");
           display(array);
           break;
        case 4:
           display(array);
           break;
     }
   } while (choice < 5);
   return 0;
}
```

```
void display(int ar[][SIZE])
{
   int l,m;
   for (l = 0; l < SIZE; l++) {
      for (m = 0; m < SIZE; m++)
         printf("%d ", ar[l][m]);
      printf("\n");
   }
}
```

# Arrays – Q2

```
void swap2Rows(int M[SIZE][SIZE], int r1,
 int r2)
/* swaps row M[r1] with row M[r2] */
{
   int temp;
   int n;     // variable for column

   for(n = 0; n < SIZE; n++) {
      temp = M[r1][n] ;
      M[r1][n] = M[r2][n];
      M[r2][n] = temp;
   }
}
```




The array is:

5 10 15

15 20 25

25 30 35

Enter two rows for swapping:

***1 2***

The new array is:

5 10 15

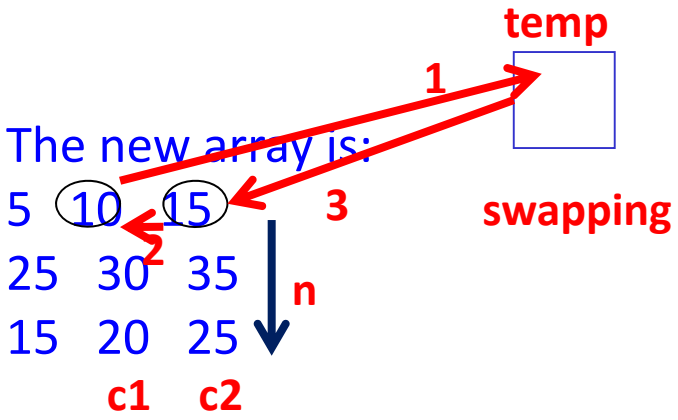
**25 30 35**

**15 20 25**

**Note: For the specified rows or columns, just perform a swapping operation for each element of the rows and columns**

# Arrays – Q2

```
void swap2Cols(int M[SIZE][SIZE], int
c1, int c2)
/* swaps column  M[][c1] with  column
M[][c2] */
{
   int temp;
   int n;     // variable for row

   for(n = 0; n < SIZE; n++) {
      temp = M[n][c1] ;
      M[n][c1] = M[n][c2];
      M[n][c2] = temp;
   }
}
```




Enter two columns for swapping:

***1 2***

The new array is:

5 **15** **10**

25 **35** **30**

15 **25** **20**

**Note: For the specified rows or columns, just perform a swapping operation for each element of the rows and columns**

# Arrays – Q3

(**reduceMatrix2D**) A square matrix (2-dimensional array of equal dimensions) can be reduced to upper-triangular form by setting each diagonal element to the sum of the original elements in that column and setting to 0s all the elements below the diagonal.

For example, the 4-by-4 matrix:

4 3 8 6
9 0 6 5
5 1 2 4
9 8 3 7

would be reduced to

**27 3 8 6**
**0 9 6 5**
**0 0 5 4**
**0 0 0 7**

Write a function to reduce a matrix with dimensions of *rowSize* and *colSize*.
The prototype of the function is:

**void reduceMatrix(int matrix[][SIZE], int rowSize, int colSize);**

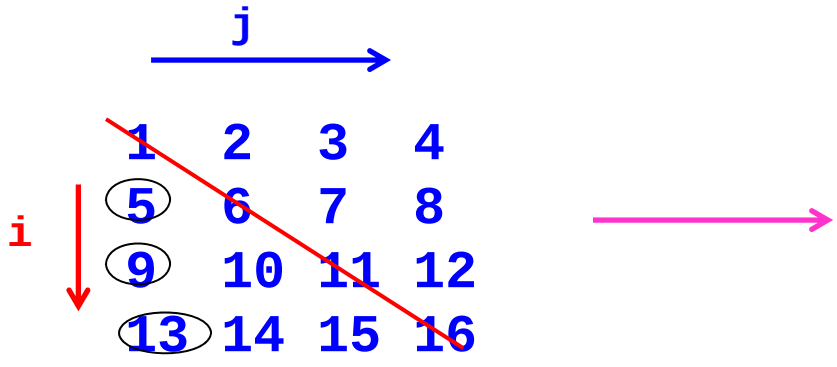
# Arrays – Q3

```
#include <stdio.h>
#define SIZE 10
void reduceMatrix2D(int ar[][SIZE], int rowSize, int colSize);
void display(int ar[][SIZE], int rowSize, int colSize);
int main()
{                                        i
   int ar[SIZE][SIZE], rowSize, colSize;
   int i,j;
   printf("Enter row size of the 2D array: \n");
   scanf("%d", &rowSize);
   printf("Enter column size of the 2D array: \n");
   scanf("%d", &colSize);
   printf("Enter the matrix (%dx%d): \n", rowSize, colSize);
   for (i=0; i<rowSize; i++)
      for (j=0; j<colSize; j++)
         scanf("%d", &ar[i][j]);

   reduceMatrix2D(ar, rowSize, colSize);
   printf("reduceMatrix2D(): \n");
   display(ar, rowSize, colSize);
   return 0;
}
void display(int ar[][SIZE], int rowSize, int colSize)
{
   int l,m;
   for (l = 0; l < rowSize; l++) {
      for (m = 0; m < colSize; m++)
         printf("%d ", ar[l][m]);
      printf("\n");
   }
}
```

# Arrays – Q3

```
void reduceMatrix2D(int matrix[][SIZE], int
rowSize, int colSize)
{
   int i, j, sum;   // i for row, j for column
   /* for each column */
   for (j = 0; j < colSize; j++){
      sum = 0;
      // process rows below the column
      for (i = j+1; i < rowSize; i++){
         sum += matrix[i][j];
         matrix[i][j] = 0;
      }
      matrix[j][j] += sum;
   }
}
```

**Enter the matrix (4x4):**

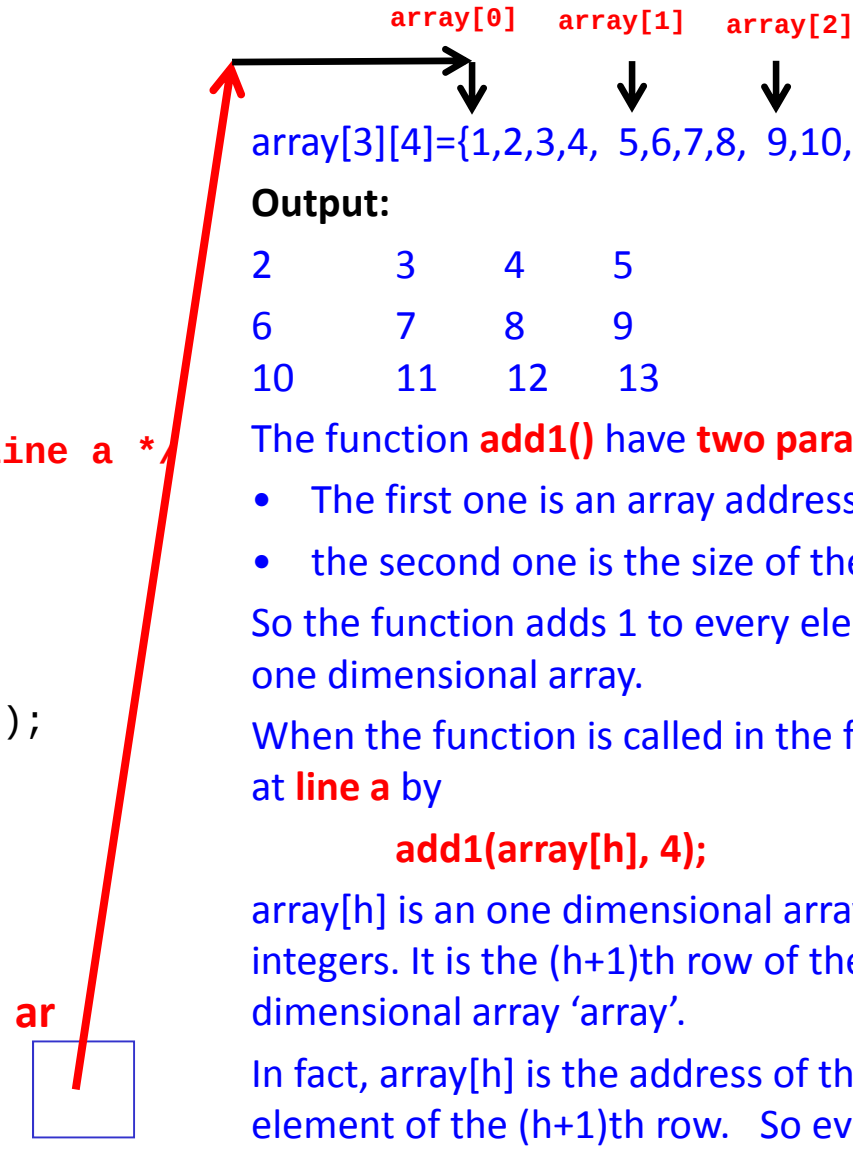



**reduceMatrix2D():**

| | | | |
|---|---|---|---|
| 28 | 2 | 3 | 4 |
| 0 | 30 | 7 | 8 |
| 0 | 0 | 26 | 12 |
| 0 | 0 | 0 | 16 |

# Arrays – Q4

```
#include  <stdio.h>
void  add1(int ar[], int size);
int main()
{
     int  array[3][4];
     int h,k;
     for (h = 0; h < 3; h++)
       for (k = 0; k < 4; k++)
         scanf("%d", &array[h][k]);

     for (h = 0; h < 3; h++)   /* line a */
       add1(array[h], 4);

     for (h = 0; h < 3; h++) {
       for (k = 0; k < 4; k++)
         printf("%10d", array[h][k]);
       putchar('\n');
     }
     return 0;
}
void add1(int ar[], int size)
{
     int k;
     for (k = 0; k < size; k++)
       ar[k]++;
}
```




array[3][4]={1,2,3,4, 5,6,7,8, 9,10,11,12}

**Output:**

| | | | |
|---|---|---|---|
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

The function **add1()** have **two parameters**.

- The first one is an array address and
- the second one is the size of the array.

So the function adds 1 to every element of the one dimensional array.

When the function is called in the for statement at **line a** by

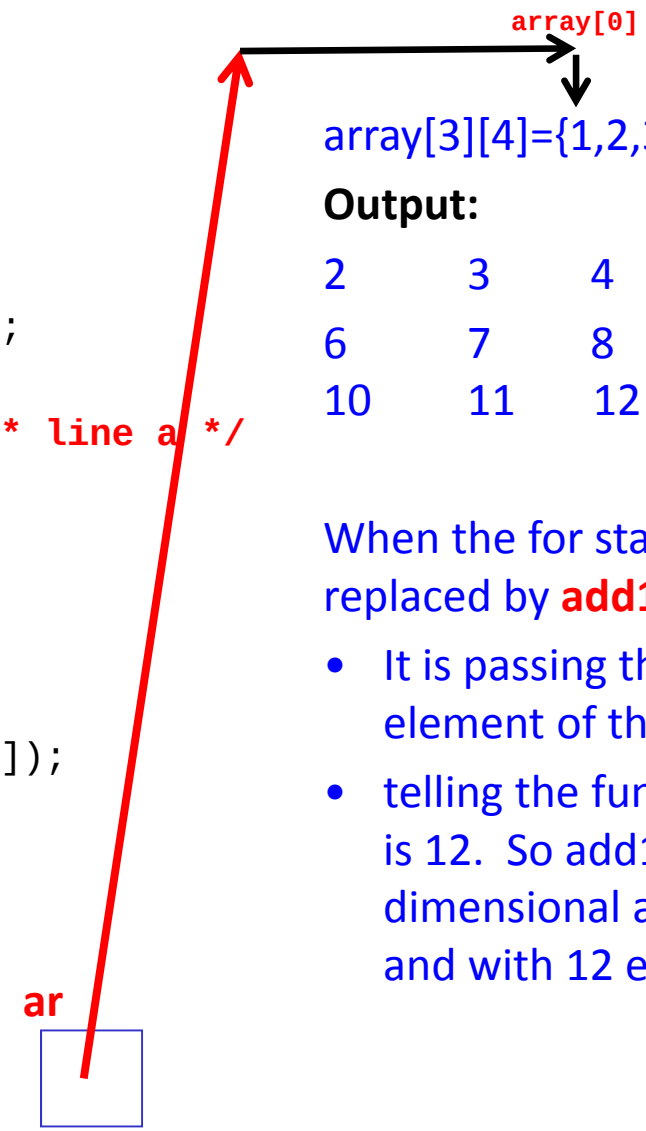
**add1(array[h], 4);**

array[h] is an one dimensional array of 4 integers. It is the (h+1)th row of the two dimensional array 'array'.

In fact, array[h] is the address of the first element of the (h+1)th row. So every function call works on one row of the two dimensional array.

# Arrays – Q4

```
#include  <stdio.h>
void  add1(int ar[], int size);
int main()
{
     int  array[3][4];
     int h,k;
     for (h = 0; h < 3; h++)
       for (k = 0; k < 4; k++)
         scanf("%d", &array[h][k]);

     //for (h = 0; h < 3; h++)   /* line a */
     // add1(array[h], 4);
     add1(array[0], 3*4);

     for (h = 0; h < 3; h++) {
       for (k = 0; k < 4; k++)
         printf("%10d", array[h][k]);
       putchar('\n');
     }
     return 0;
}
void add1(int ar[], int size)
{
     int k;
     for (k = 0; k < size; k++)
       ar[k]++;
}
```




array[3][4]={1,2,3,4,5,6,7,8,9,10,11,12}

**Output:**

| | | | |
|---|---|---|---|
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

When the for statement at line a is replaced by **add1(array[0], 3*4)**:

- It is passing the address of the first element of the first row to add1() and
- telling the function that the array size is 12. So add1() works on an one dimensional array starting at array[0] and with 12 elements.