Programming with C and C++

CSC-101 (Lecture 16)

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Two Dimensional Array in C

- Declaration of two dimensional Array in C
- `data_type array_name[rows][columns];`
- `int a[10][10];`

</> source code

```
1  #include <stdio.h>
2  void main ()
3  {
4      int arr[3][3],i,j;
5      for (i=0;i<3;i++)
6      {
7          for (j=0;j<3;j++)
8          {
9              printf("Enter a[%d][%d]: ",i,j);
10             scanf("%d",&arr[i][j]);
11         }
12     }
```

```
13          printf("\n printing the elements ....\n");
14          for(i=0;i<3;i++)
15          {
16              printf("\n");
17              for (j=0;j<3;j++)
18              {
19                  printf("%d\t",arr[i][j]);
20              }
21          }
22  }
```

https://ideone.com/dL9sjF

Success #stdin #stdout 0.01s 5536KB

comments (0)

stdin

copy

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

stdout

copy

```
Enter a[0][0]: Enter a[0][1]: Enter a[0][2]: Enter a[1][0]: Enter a[1][1]: Enter a[1]
[2]: Enter a[2][0]: Enter a[2][1]: Enter a[2][2]:
 printing the elements ....

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

Some Famous Problems in 1-D Array

- Write a program to check if two strings are anagrams of each other in C.
  - "listen" and "silent",
  - "cinema" and "iceman“
  - "debit card" and "bad credit" are anagrams

- Take an input n from the user where n is an integer. Write a C program to print the prime numbers less than n (Famous **Sieve of Eratosthenes algorithm** takes $n \log\log(n)$ steps and **Sieve of Atkin** takes $n / \log\log(n)$ steps).

Addition of two matrices

</> source code

```c
#include <stdio.h>
int main() {
    // Declare two matrices with 3 rows and 4 columns
    int matrix1[3][4], matrix2[3][4];

    // Assign values to the first matrix
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 4; j++) {
            matrix1[i][j] = i * 2 + j;
        }
    }

```

```
12
13      // Assign values to the second matrix
14      for (int i = 0; i < 3; i++) {
15          for (int j = 0; j < 4; j++) {
16              matrix2[i][j] = i * 3 + j;
17          }
18      }
19
20      // Declare a new matrix to store the result of the addition
21      int result[3][4];
22
23      // Add the two matrices and store the result in the new matrix
24      for (int i = 0; i < 3; i++) {
25          for (int j = 0; j < 4; j++) {
26              result[i][j] = matrix1[i][j] + matrix2[i][j];
27          }
28      }
```

```
29
30      // Print the result
31      for (int i = 0; i < 3; i++) {
32          for (int j = 0; j < 4; j++) {
33              printf("%d ", result[i][j]);
34          }
35          printf("\n");
36      }
37
38      return 0;
39  }
```

input Output

Success #stdin #stdout 0s 5512KB

```
0 2 4 6
5 7 9 11
10 12 14 16
```

https://ideone.com/3Dmu5U

Two Dimensional Arrays

- Row major form

Example 1

</> source code

```c
#include <stdio.h>

int main(void) {
    int a[3][3]={1,2,3,4,5,6};
for (int i=0; i<3; i++)
{ for (int j=0; j<3; j++)
printf("%d ",a[ i ][ j ]);
printf("\n");
}
    return 0;
}

```

```
1 2 3
4 5 6
0 0 0
```

https://ideone.com/UtfpZs

Example 2

</> source code

https://ideone.com/Mx8o8l

```
1  #include <stdio.h>
2
3  int main(void) {
4      int a[3][3]={1,2,3,4,5,6};
5  for (int i=0; i<3; i++)
6  { for (int j=0; j<7; j++)
7  printf("%d ",a[ i ][ j ]);
8  printf("\n");
9  }
10     return 0;
11 }
```

Output:

1	2	3	G1	G2	G3	G4
4	5	6	G5	G6	G7	G8
0	0	0	G9	G10	G11	G12

stdout

```
1 2 3 4 5 6 0
4 5 6 0 0 0 5363
0 0 0 5363 -1470879232 1508767036 1001013808
```

Example 3

</> source code

```c
#include <stdio.h>

int main(void) {
    int a[][3]={1,2,3,4,5,6};
for (int i=0; i<3; i++)
{ for (int j=0; j<3; j++)
printf("%d ",a[ i ][ j ]);
printf("\n");
}
    return 0;
}
```

Output:

```
1   2   3
4   5   6
G1  G2  G3
```

https://ideone.com/QeuXU6

stdout

```
1 2 3
4 5 6
1865216768 -481731980 0
```

Example 4

</> source code

https://ideone.com/GtR4PC

```
1   #include <stdio.h>
2
3   int main(void) {
4       int a[][3]={1,2,3,4,5,6};
5   for (int i=0; i<3; i++)
6   { for (int j=0; j<7; j++)
7   printf("%d ",a[ i ][ j ]);
8   printf("\n");
9   }
10      return 0;
11  }
12
```

Output:

```
1   2   3   G1  G2  G3  G4
4   5   6   G5  G6  G7  G8
G9  G10 G11 G12 G13 G14 G15
```

stdout

```
1 2 3 4 5 6 -731768064
4 5 6 -731768064 1741953178 -2071743968 22062
-731768064 1741953178 -2071743968 22062 0 0 -2071743968
```

Example 5

</> source code

```
1  #include <stdio.h>
2
3  int main(void) {
4      int a[][3]={1,2,3,4,5,6,7};
5  for (int i=0; i<3; i++)
6  { for (int j=0; j<3; j++)
7  printf("%d ",a[ i ][ j ]);
8  printf("\n");
9  }
10     return 0;
11 }
12
```

stdout

```
1 2 3
4 5 6
7 0 0
```

https://ideone.com/9JT6Ko

Example 6

</> source code

https://ideone.com/nOnvYM

```
1  #include <stdio.h>
2
3  int main(void) {
4      int a[3][]={1,2,3,4,5,6};
5  for (int i=0; i<3; i++)
6  { for (int j=0; j<3; j++)
7  printf("%d ",a[ i ][ j ]);
8  printf("\n");
9  }
10     return 0;
11 }
12
```

compilation info

```
prog.c: In function ‘main’:
prog.c:4:6: error: array type has incomplete element type ‘int[]’
  int a[3][]={1,2,3,4,5,6};
      ^
```

Address of $[i_1][i_2]^{th}$ location element in a 2D-Array

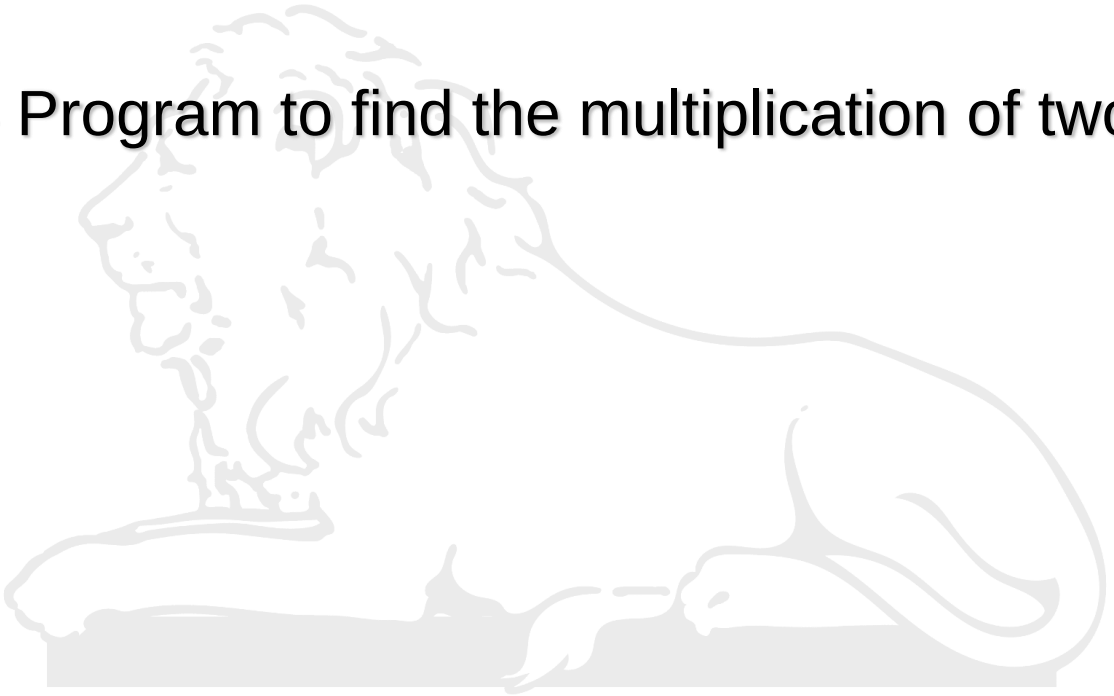
Given $a[r_1][r_2]$ array,

r_1-No. of rows, r_2-No. of Cols.

$0 \leq i_1 < r_1$ and $0 \leq i_2 < r_2$, finding the address of $a[i_1][i_2]$

$$\&a[i_1][i_2] = \&a[0][0] + (i_1 * r_2 + i_2) * e\_size;$$

- Write a C Program to find the multiplication of two matrices.



Matrix multiplication

```c
#include <stdio.h>

int main() {
    int mat1[10][10], mat2[10][10], result[10][10];
    int row1, col1, row2, col2;
    int i, j, k;

    printf("Enter the number of rows and columns for the first matrix: ");
    scanf("%d %d", &row1, &col1);

    printf("Enter the elements of the first matrix:\n");
    for (i = 0; i < row1; i++) {
        for (j = 0; j < col1; j++) {
            scanf("%d", &mat1[i][j]);
        }
    }

```

```
18      printf("Enter the number of rows and columns for the second matrix: ");
19      scanf("%d %d", &row2, &col2);
20
21      if (col1 != row2) {
22          printf("Matrix multiplication is not possible. Col1,row2 should be same.\n");
23          return 1; // Exit with an error code
24      }
25
26      printf("Enter the elements of the second matrix:\n");
27      for (i = 0; i < row2; i++) {
28          for (j = 0; j < col2; j++) {
29              scanf("%d", &mat2[i][j]);
30          }
31      }
32
```

```
33      // Initialize the result matrix with zeros
34      for (i = 0; i < row1; i++) {
35          for (j = 0; j < col2; j++) {
36              result[i][j] = 0;
37          }
38      }
39
40      // Multiply the matrices
41      for (i = 0; i < row1; i++) {
42          for (j = 0; j < col2; j++) {
43              for (k = 0; k < col1; k++) {
44                  result[i][j] += mat1[i][k] * mat2[k][j];
45              }
46          }
47      }
48
```

```
49      // Display the result matrix
50      printf("Resultant matrix after multiplication:\n");
51      for (i = 0; i < row1; i++) {
52          for (j = 0; j < col2; j++) {
53              printf("%d ", result[i][j]);
54          }
55          printf("\n");
56      }
57
58      return 0;
59  }
```

stdin

```
2 2
1 2
3 4
2 2
2 3
4 5
```

```
Resultant matrix after multiplication:
10 13
22 29
```

Some Important matrix related problems

- Determinant of the matrix
- Eigenvalues and Eigenvectors
- Explain how you can use a two-dimensional array to implement a Sudoku solver.
- Write a C program to generate a $n \times n$ magic square using a two-dimensional array, where n is an odd number.

Some String functions

Method	Description
strcat()	It is used to concatenate(combine) two strings
strlen()	It is used to show the length of a string
strrev()	It is used to show the reverse of a string
strcpy()	Copies one string into another
strcmp()	It is used to compare two string

Thank You!