

Computer Programming 1 Lab

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Mozix Chien



Outline

- Array
- Two-dimensional array
- Example
- Exercise



Array



Array

consider the following condition

What if I want to record all student's attendance in the class ?



Array

solution ?

~~int studentA, studentB, studentC ...~~

~~int studentAA, studentAB ...~~

...



Array

solution

```
int students[100];
```



Array

Declaration

```
T arr[N];
```

- Declares arr as an array object that consists of N contiguously allocated objects of type T.
- T : data type
- N : amount of elements
- arr : variable name



Array

Examples

```
#include <stdio.h>

int main(void){
    int students[100];
    double coordinateX[200];
    double coordinateY[200];
}
```



Array

- For a N elements array, index is from **0** to **N-1**

```
int arr[10];  
// arr[0], arr[1], arr[2] ... arr[9]
```



Array

Initialization

```
int arr1[5];  
// we dont know which value is in any index  
int arr2[5] = {1, 2, 3, 4, 5};  
// arr[0] = 1, arr[1] = 2, arr[2] = 3, arr[3] = 4, arr[4] = 5  
int arr3[5] = {1, 2, 3}  
// arr[0] = 1, arr[1] = 2, arr[2] = 3, arr[3] = 0, arr[4] = 0  
int arr3[5] = {}  
// arr[0] = 0, arr[1] = 0, arr[2] = 0, arr[3] = 0, arr[4] = 0
```



Array

Initialization

```
int arr[] {1, 2, 3};  
int size = sizeof(arr)/sizeof(int); // 3
```



Array

char array

- for all string in c, you must preserve a space for '\0'
'\0' is a terminating null character

```
char str[] = "abc"; // 'a', 'b', 'c', '\0'
```



Array

Traversal

```
#define N 10

int arr[N] = {};

for(int i=0; i<N; i++){
    arr[i] = i;
}

for(int i=0; i<N; i++){
    scanf("%d ", &arr[i]);
}

for(int i=0; i<N; i++){
    printf("%d ", arr[i]);
}
```



Two-dimensional array



Two-dimensional array

Declaration

```
T arr[rowSize][columnSize];
```

	Column 0	Column 1	Column 2	Column 3
Row 0	a[0][0]	a[0][1]	a[0][2]	a[0][3]
Row 1	a[1][0]	a[1][1]	a[1][2]	a[1][3]
Row 2	a[2][0]	a[2][1]	a[2][2]	a[2][3]

Diagram illustrating the structure of a 2D array with 3 rows and 4 columns. The array is represented as a grid of elements. The first row is labeled Row 0, the second Row 1, and the third Row 2. The columns are labeled Column 0, Column 1, Column 2, and Column 3. Each element is shown as a blue box containing its memory address, e.g., a[0][0].

Arrows indicate the indexing structure:

- Column index: Points to the second index (the column index) in the address a[2][1].
- Row index: Points to the first index (the row index) in the address a[2][1].
- Array name: Points to the variable name 'a' in the address a[2][1].



Two-dimensional array

Initialization

```
int arr1[3][2] = {1, 2, 3, 4, 5, 6};  
// arr1 = [1, 2]  
//        [3, 4]  
//        [5, 6]
```



Two-dimensional array

Initialization

```
int arr2[3][2] = { {1, 2}, {3, 4}, {5, 6} };  
int arr3[3][2] = {  
    {1, 2},  
    {3, 4},  
    {5, 6}  
};
```



Two-dimensional array

Initialization

```
int arr[3][2] = {};  
// arr = [0, 0]  
//       [0, 0]  
//       [0, 0]
```



Two-dimensional array

Traversal

```
#define N 10
#define M 20

int arr[N][M] = {};

for(int i=0; i<N; i++){
    for(int j=0; j<M; j++){
        scanf("%d ", &arr[i][j]);
    }
}

for(int i=0; i<N; i++){
    for(int j=0; j<M; j++){
        printf("%d ", arr[i][j]);
    }
}
```



Example



Example 1

給你一群數字，將數字倒過來，並輸出結果

- input sample

```
5  
9 5 1 3 3
```

- output sample

```
3 3 1 5 9
```



Example 1

給你一群數字，將數字倒過來，並輸出結果

```
int n, arr[1000];
scanf("%d",&n);
for(int i=0;i<n;i++){
    scanf("%d", &arr[i]);
}
for(int i=n-1;i>=0;i--){
    printf("%d ", arr[i]);
}
```



Example 2

給你一群數字，希望任兩個人的成績能夠交換，並輸出結果

- input sample

```
5
100 98 95 100 60
4
1 4
2 5
2 4
1 5
```

- output sample

```
98 100 95 60 100
```



Example 2

```
int n, nums[100];
scanf("%d", &n);
for(int i=0; i<n; i++){
    scanf("%d", &nums[i]);
}

int q;
scanf("%d", &q);
for(int i=0; i<q; i++){
    int a, b;
    scanf("%d %d", &a, &b);
    swap(nums[a], nums[b]);
}
for(int i=0; i<n; i++){
    printf("%d ", nums[i]);
}
```



Exercise



Exercise

There are many rectangles in plane coordinates. You are given all the information of rectangles. Please calculate the intersection area of these rectangles.

- Input:

First line, you are given a integer N . The following N lines contains four numbers, which are x_1 y_1 x_2 y_2 , standing for the upper-left and bottom-right respectively.

- Output:

The intersection area of the rectangle.



Any Questions?

