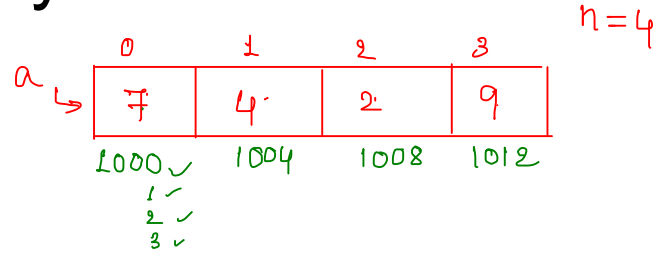


Introduction to Multi-dimensional Arrays

✓ 1D Array:



Assume

$\text{size}(\text{int}) = 4\text{B} \checkmark$

Base add's = 1000 ✓

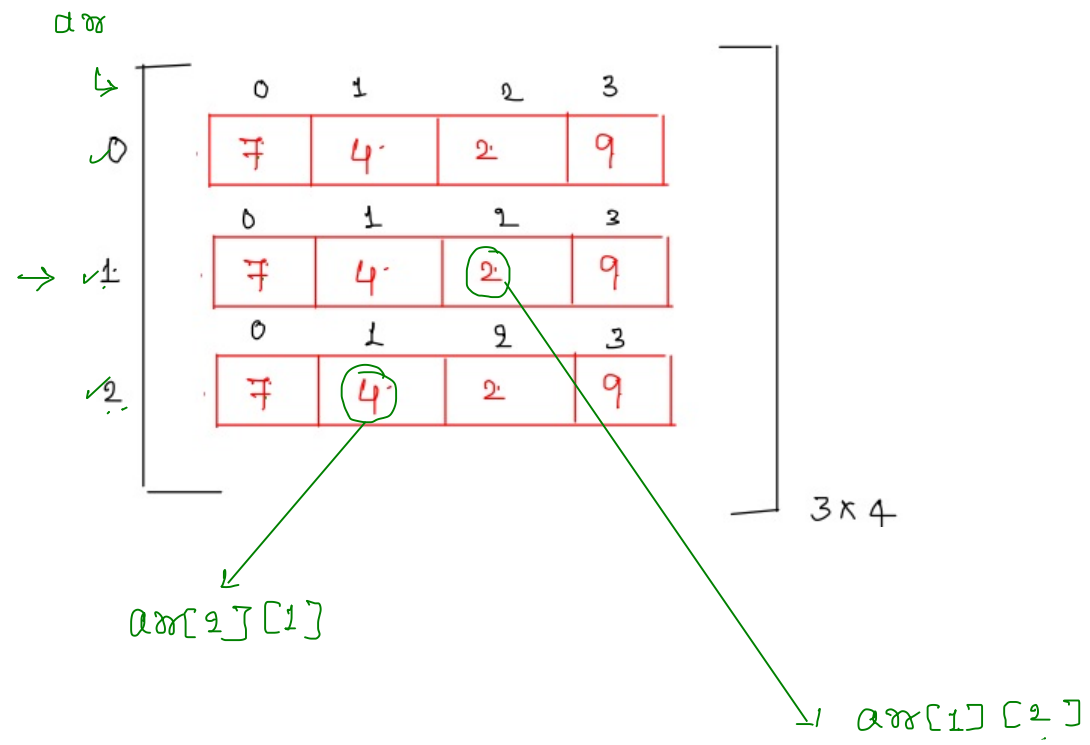
- 1) All the elements in the 1d array are of same type
- 2) the memory locations should be contiguous

2D Array :-

↳ collection of 1D Arrays.

	0	1	2	3
0	7	4	2	9
1	7	4	2	9
2	7	4	2	9

3 - 1D arrays
3 × 4
size of each 1D array = 4

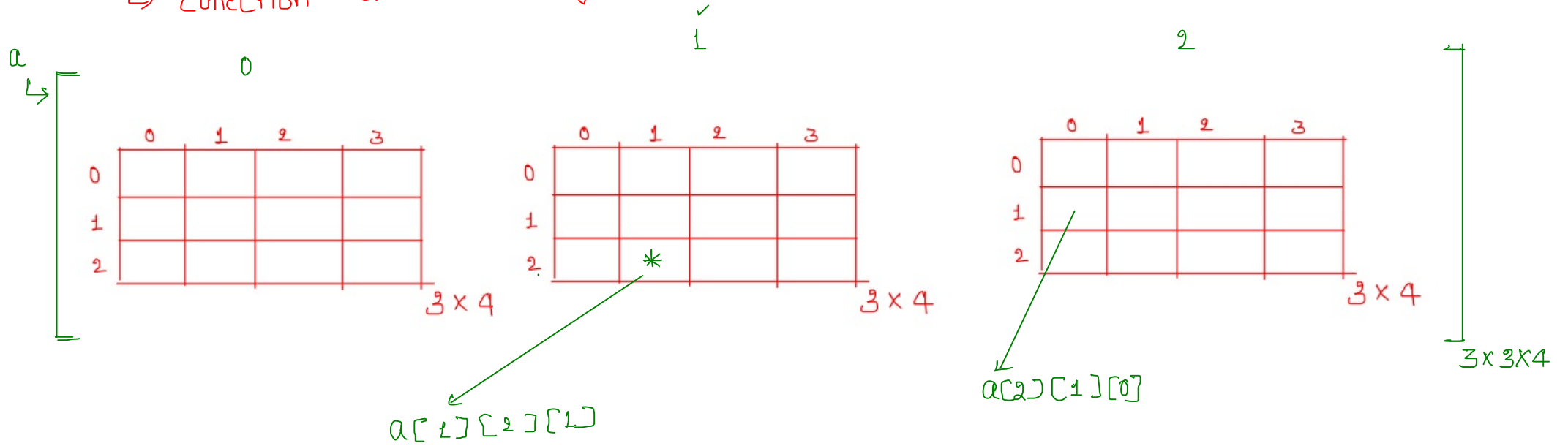


print(arr[2][5]) → error

$c[j][i]$

✓ 3D Array :-

↳ collection of 2D arrays.



Q) Print the Diagonal elements of a square matrix :-

Assume print again

↓

$a_{00}, a_{11}, a_{22}, a_{33}, a_{44},$ $a_{04}, a_{13}, a_{22}, a_{31}, a_{40}$

A

↳

	0	1	2	3	4
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	a_{22}	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	a_{33}	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}

5x5

Q) Print the Diagonal elements of a square matrix :-

Assume print again

$a_{00}, a_{11}, a_{22}, a_{33}, a_{44},$ $a_{04}, a_{13}, a_{22}, a_{31}, a_{40}$

A

	0	1	2	3	4
0	<u>a_{00}</u>	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	<u>a_{11}</u>	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	<u>a_{22}</u>	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	<u>a_{33}</u>	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	<u>a_{44}</u>

5x5
n x n

```
function printDiagonalElements(arr,n)
{
    for(i=0;i<n;i++)
    {
        print(arr[i][i])
    }
}
```

Q) Print the Diagonal elements of a square matrix :-

A

	0	1	2	3	4
0	a ₀₀	a ₀₁	a ₀₂	a ₀₃	a ₀₄
1	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄
2	a ₂₀	a ₂₁	a ₂₂	a ₂₃	a ₂₄
3	a ₃₀	a ₃₁	a ₃₂	a ₃₃	a ₃₄
4	a ₄₀	a ₄₁	a ₄₂	a ₄₃	a ₄₄

5x5
n x n

~~2 for loops~~
 ~~$i+j = n-1$~~

Assume print again

a₀₄, a₁₃, a₂₂, a₃₁, a₄₀

```
function printDiagonalElements(arr,n)
{
    i=0, j=n-1
    while(i<n and j>=0)
    {
        print(arr[i][j])
        i=i+1
        j=j-1
    }
}
```

i	j
0 ✓	4 ✓
1	3
2	2
3	1
4	0
n-1	0

$n \times n = 5 \times 5$

$\begin{matrix} i & j \\ a_{22} \end{matrix} \rightarrow \text{Skip}$

A

\rightarrow

i

j

∞ loop

	0	1	2	3	4
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	a_{22}	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	a_{33}	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}

5x5

function printDiagonalElements(arr,n)

```
{
    i=0, j=n-1
    while(i<n and j>=0)
    {
        if(i!=j)
        {
            print(arr[i][j])
        }
        i=i+1
        j=j-1
    }
}
```

```
function printDiagonalElements(arr,n)
```

```
{
```

```
    for(i=0;i<n;i++)
```

```
    {
```

```
        print(arr[i][i])
```

```
    }
```

```
    i=0, j=n-1
```

```
    while(i<n and j>=0)
```

```
    {
```

```
        if(i!=j)
```

```
        {
```

```
            print(arr[i][j])
```

```
        }
```

```
        i=i+1
```

```
        j=j-1
```

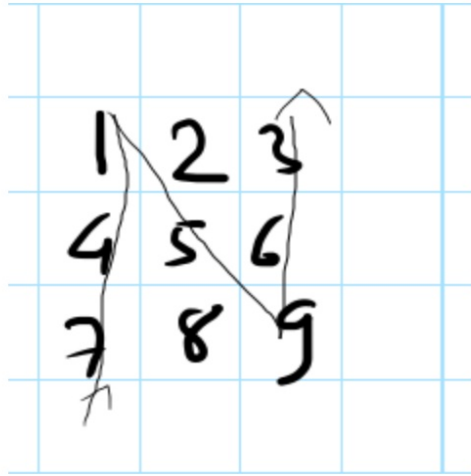
```
    }
```

```
}
```

✓N traversal

Description

You are given a matrix of size $n \times n$. Find the Ntraversal of the matrix. Refer the following figure for better understanding.



↳ square matrix

Input

The first line contains T , the number of test cases. The first line of each test case contains N , the size of the square matrix.

Next N lines contain N space separated integers, denoting the values of the matrix.

$a[i][j]$

$n \times n = 5 \times 5$

$a_{40}, a_{30}, a_{20}, a_{10}, a_{00}$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $n-1$

```
for(i=n-1; i>0; i--)  
{  
    print(a[i][0])  
}
```

① ✓

A

	0	1	2	3	4
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	a_{22}	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	a_{33}	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}

5x5

②

$a_{11}, a_{22}, a_{33}, a_{44}$

$i=1$ to $n-1$

```
for(i=1; i<n; i++)  
{  
    print(a[i][i])  
}
```

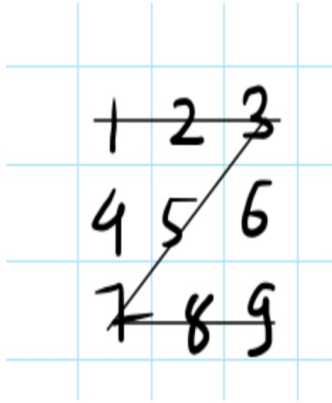
$n=5$

$a_{34}, a_{24}, a_{14}, a_{04}$
 $\uparrow \uparrow$ fixed $(n-1)$
 $i=n-2$ to 0

```
for(i=n-2; i>0; i--)  
{  
    print(a[i][n-1])  
}
```

Description

Given a square matrix of size $N \times N$. Print the Z traversal of the matrix. Refer the figure given below for better understanding.



Input

The first line of the input contains T , the number of test cases. The first line of each test case contains N , the dimension of the square matrix.

Next N lines contains N space separated integers, denoting the values of the matrix.

Constraints

$$1 \leq T \leq 10$$

$$1 \leq N \leq 500$$

$$1 \leq A[i][j] \leq 1000$$

Output

$n \times n = 5 \times 5$

A	0	1	2	3	4
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	a_{22}	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	a_{33}	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}

5x5

$a_{00}, a_{01}, a_{02}, a_{03}, a_{04}$
 $j=0$ to $n-1$

```
for(j=0; j<n; j++)
{
    print(arr[0][j])
}
```

$j=0$
 1
 2
 3
 4

$a_{41}, a_{42}, a_{43}, a_{44}$
 $i=n-1, j=1 \rightarrow n-1$

```
for(j=1; j<n; j++)
{
    print(arr[n-1][j])
}
```

②

$a_{13}, a_{22}, a_{31}, a_{40}$
 $i=1 \rightarrow 4$
 $j=3 \rightarrow 0$

```
i=1, j=n-2
while(i<n and j>=0)
{
    print(arr[i][j])
    i=i+1
    j=j-1
}
```

Circular Traversal

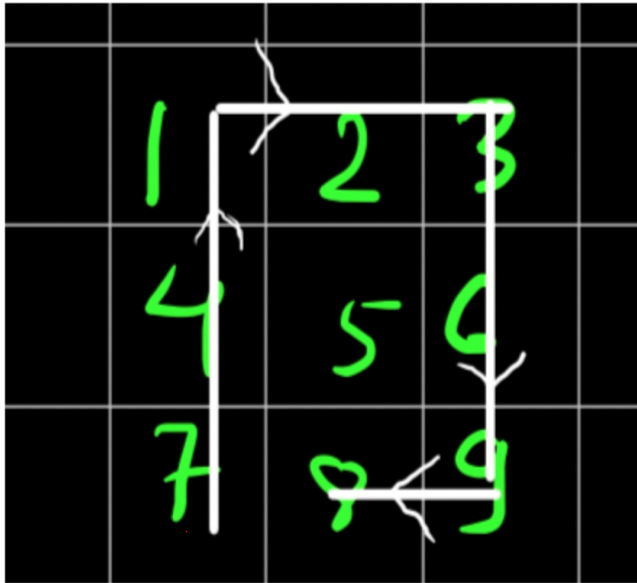
● -13:6:59

Edit

Description

Given a square matrix, you have to find the reverse U traversal of the matrix. Refer the sample I/O for better understanding. Refer the given figure for better understanding.

Note: No element should be visited more than once.



circular Traversal:-

$n \times n = 5 \times 6$
m x n

i j

①

$a_{40}, a_{30}, a_{20}, a_{10}, a_{00}$
 $i = n-1$ to 0

```
for(i=m-1; i>=0; i--)
{
    print(arr[i][0])
}
```

②

$a_{01}, a_{02}, a_{03}, a_{04}, a_{05}$
 $j = 1$ to $n-1$

```
for(j=1; j<n; j++)
{
    print(arr[0][j])
}
```

H/W

①

	0	1	2	3	4	5
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}	a_{05}
1	a_{10}					a_{15}
2	a_{20}					a_{25}
3	a_{30}					a_{35}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}

5 x 6

④

③

$a_{15}, a_{25}, a_{35}, a_{45}$
 $i = 1$ to $m-1$
 $j = n-1$

```
for(i=1; i<m; i++)
{
    print(arr[i][n-1])
}
```


A

↳

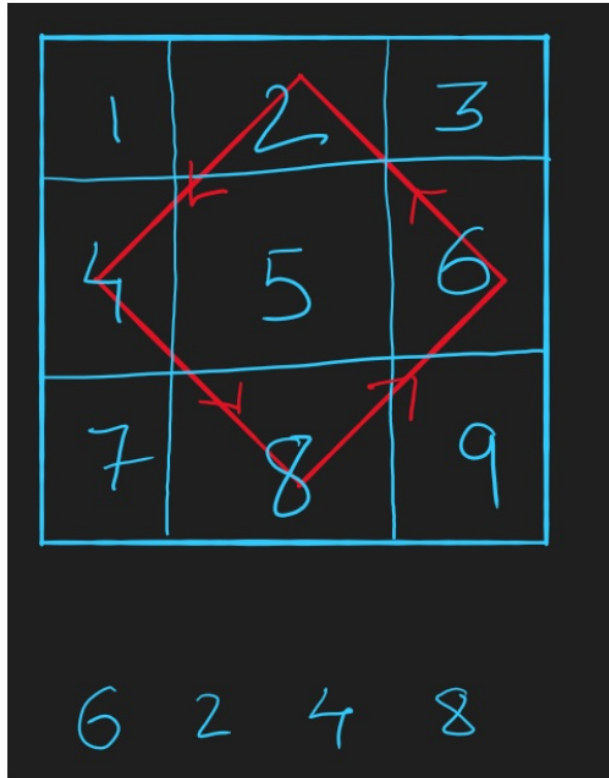
	0	1	2	3	4
0	a_{00}	a_{01}	a_{02}	a_{03}	a_{04}
1	a_{10}	a_{11}	a_{12}	a_{13}	a_{14}
2	a_{20}	a_{21}	a_{22}	a_{23}	a_{24}
3	a_{30}	a_{31}	a_{32}	a_{33}	a_{34}
4	a_{40}	a_{41}	a_{42}	a_{43}	a_{44}

5x5

Diamond Traversal

Description

Given a square matrix of odd length , print the matrix elements in the order shown in the figure :



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