

2. Traversal Techniques

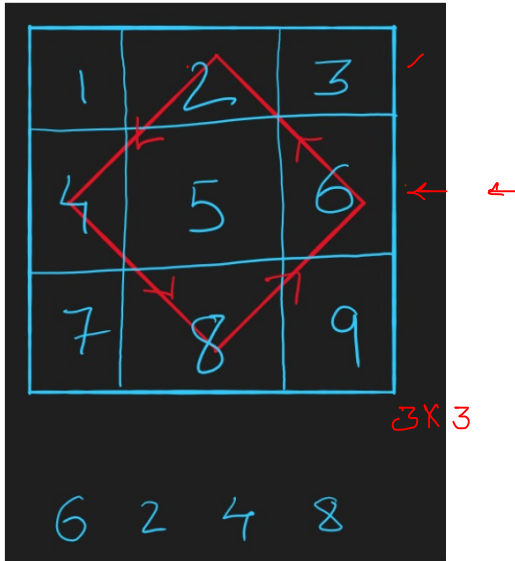
Diamond Traversal :-

Description

an

→ 3x3, 5x5, 7x7, ... ✓ ✓

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



a ↗

0				↓				
1				✓				
2								
3								
4								
5								
6								
7								
8								

↗

$n \times n = 9 \times 9$

$\lfloor \frac{9}{2} \rfloor = 4 \text{ // } 2$

↓ 3



$a_{48}, a_{37}, a_{26}, a_{15}, a_{04}$

$i \leftarrow j$

$i: 4 \text{ to } 0 \rightarrow i = \frac{n}{2} \text{ to } 0$

$j: 8 \text{ to } 4 \rightarrow j = n-1 \text{ to } \frac{n}{2}$

← Halt



$a_{13}, a_{22}, a_{31}, a_{40}$

$i \leftarrow j$

$i: 1 \text{ to } 4 \rightarrow i = 1 \text{ to } \frac{n}{2}$

$j: 3 \text{ to } 0 \rightarrow j = \frac{n}{2} - 1 \text{ to } 0$

9x9



a_{75}, a_{66}, a_{57}

$i \leftarrow j$

$i: 7 \text{ to } 5 \rightarrow n-2 \text{ to } \frac{n}{2} + 1$

$j: 5 \text{ to } 7 \rightarrow \frac{n}{2} + 1 \text{ to } n-2$



$a_{51}, a_{62}, a_{73}, a_{84}$

$i \leftarrow j$

$i: 5 \text{ to } 8 \rightarrow \frac{n}{2} + 1 \text{ to } n-1$

$j: 1 \text{ to } 4 \rightarrow 1 \text{ to } \frac{n}{2}$

→ → →

Spiral Traversal

→

10-minis

a00	a01	a02	a03	a04	a05	a06
a10	a11	a12	a13	a14	a15	a16
a20	a21	a22	a23	a24	a25	a26
a30	a31	a32	a33	a34	a35	a36
a40	a41	a42	a43	a44	a45	a46
a50	a51	a52	a53	a54	a55	a56
a60	a61	a62	a63	a64	a65	a66

7x7

$R_1 \rightarrow$ circular Trav.

$R_2 \rightarrow$ " "

$R_3 \rightarrow$ " "

$R_4 \rightarrow$ " " function spiralTraversal(arr,n)
{

}

WOW

left right

$n \times n = 7 \times 7$

49

dry-run ✓

function spiralTraversal(arr,n)
{

top=0,bottom=n-1,left=0,right=n-1

$c=0$

while(top<=bottom and left<=right)

{

for(j=left;j<=right;j++)

{

print(arr[top][j])

$c++$

}

top=top+1

for(i=top;i<=bottom;i++)

{

print(arr[i][right])

$c++$

}

right=right-1

for(j=right;j>=left;j--)

{

print(arr[bottom][j])

$c++$

}

bottom=bottom-1

for(i=bottom;i>=top;i--)

{

print(arr[i][left])

$c++$

}

left=left+1

}

$m \times n$

$c \leq m+n$

$c = 0, 1, 2, \dots$

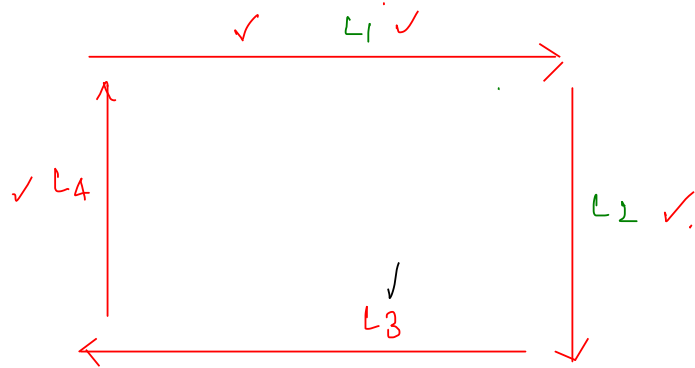
49

50 fail

top
bottom

	0	1	2	3	4	5	6
0	a00	a01	a02	a03	a04	a05	a06
1	a10	a11	a12	a13	a14	a15	a16
2	a20	a21	a22	a23	a24	a25	a26
3	a30	a31	a32	a33	a34	a35	a36
4	a40	a41	a42	a43	a44	a45	a46
5	a50	a51	a52	a53	a54	a55	a56
6	a60	a61	a62	a63	a64	a65	a66

7x7



}

Q) Find the Transpose of a Matrix $[N \times N]$

	0	1	2	3
0	a	b	c	d
1	e	f	g	h
2	i	j	k	l
3	m	n	o	p

M. 4×4

M^T

	0	1	2	3
0	a	e	i	m
1	b	f	j	n
2	c	g	k	o
3	d	h	l	p

original matrix

Transposed matrix

a

	0	1	2	3
0	a	b	c	d
1	e	f	g	h
2	i	j	k	l
3	m	n	o	p

4x4

O/P

	0	1	2	3
0	a	e	i	m
1	b	f	j	n
2	c	g	k	o
3	d	h	l	p

4x4

i=0
 0 0 → 0 0
 0 1 → 1 0 ✓
 0 2 → 2 0
 0 3 → 3 0

i=1
 1 0 → 0 1
 1 1 → 1 1
 1 2 → 2 1
 1 3 → 3 1

i=2

$M[i][j] \leftrightarrow M[j][i]$
 Swapping

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

{

for(j=0; j<n; j++)

{

temp=arr[i][j]

arr[i][j]=arr[j][i]

arr[j][i]=temp

}

}

swap
 arr[i][j] and
 arr[j][i]

i/p



	0	1	2	3
0	a	b	c	d
1	e	f	g	h
2	i	j	k	l
3	m	n	o	p

M

o/p

	0	1	2	3
0	a	e	i	m
1	b	f	j	n
2	c	g	k	o
3	d	h	l	p

b v/s e

i/p

	0	1	2	3
0	a	b	i	m
1	e	f	j	h
2	c	g	k	l
3	d	n	o	p

M

	0	1	2	3
0	a	b	c	d
1	e	f	g	h
2	i	j	k	l
3	m	n	o	p

M

H/w

→ for(i=0; i<n; i++)

{

for(j=i; j<n; j++)

{

```
temp=arr[i][j]
arr[i][j]=arr[j][i]
arr[j][i]=temp
```

}

}

arr[i][j] swap

1 0
2

arr[j][i]
0 1
2

Correct Code for Transpose is as follows:

→ H/W ✓

```
for(i=0;i<n;i++)  
{  
    for(j=i+1;j<n;j++)  
    {  
        1. temp=arr[i][j]  
        2. arr[i][j]=arr[j][i]  
        3. arr[j][i]=temp  
    }  
}
```

finding the Transpose of matrix.

Q) Rotate N*N Matrix 90 degrees Clock Wise [you should not use any extra array]

i/p

	0	1	2	3	4
0	a	b	c	d	e
1	f	g	h	i	j
2	k	l	m	n	o
3	p	q	r	s	t
4	u	v	w	x	y

5x5

90°



4	3	2	1	0	
u	p	k	f	a	0
v	q	l	g	b	1
w	r	m	h	c	2
x	s	n	i	d	3
y	t	o	j	e	4

o/p

u	p	k	f	a
v	q	l	g	b
w	r	m	h	c
x	s	n	i	d
y	t	o	j	e

i/p [M]

	0	1	2	3	4
0	a	b	c	d	e
1	f	g	h	i	j
2	k	l	m	n	o
3	p	q	r	s	t
4	u	v	w	x	y

after rotating 90°
clock wise

O/p

u	p	k	f	a
v	q	l	g	b
w	r	m	h	c
x	s	n	i	d
y	t	o	j	e

Step₁
/MT/
find transpose
of a matrix

a	f	k	p	u
b	g	l	q	v
c	h	m	r	w
d	i	n	s	x
e	j	o	t	y

Step₂: reverse the rows.

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
✓ 2	9	10	11	12
3	13	14	15	16

$k = 11 \rightarrow x = 2, y = 2$
0, 0

starting: $\begin{matrix} 2, 2 \\ \downarrow \downarrow \\ 1 \quad 1 \end{matrix} \rightarrow \begin{matrix} \text{one value} \\ \text{is 0, stop} \end{matrix}$
 ending: $\begin{matrix} \downarrow +1 \\ 1 \quad 1 \quad \checkmark \\ \downarrow +1 \\ 2 \quad 2 \quad \checkmark \\ \downarrow +1 \\ 3 \quad 3 \quad \checkmark \\ \downarrow +1 \\ 4 \quad 4 \quad \text{stop} \end{matrix}$

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12
3	13	14	15	16

4x4

k=7

starting: 0 1 $\xrightarrow{+1}$ 1 2 $\xrightarrow{+1}$ 2 3 $\downarrow +1$
3 4
 stop

finding (1)

1 2
 $\downarrow -1$
 x. 0 1 \rightarrow starting
 $\downarrow -1$
 -1 0 \leftarrow x $+1 +1 +1$

0 0 \rightarrow 3 3
 ✓

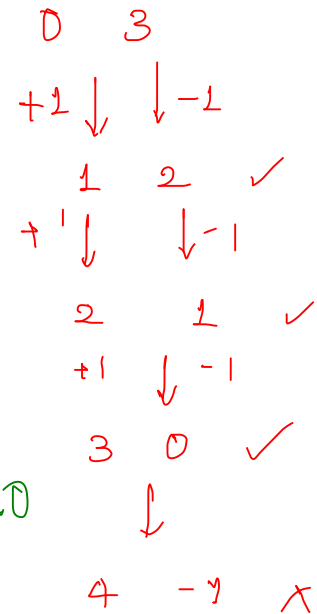
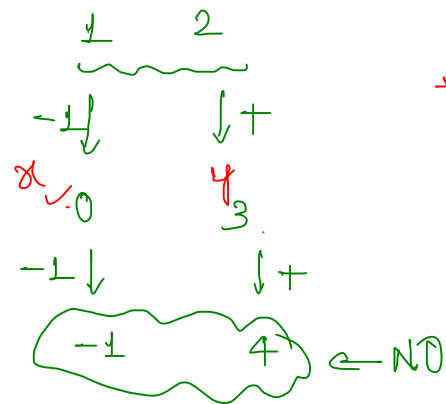
	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12
3	13	14	15	16

$k=7$

starting: ?

o/p

0 3, 1 2, 2 1, 3 0



1 2 3		1 4 7		7 4 1	
4 5 6	—Transpose—>	2 5 8	—Reverse individual rows—>	8 5 2	(Resultant matrix)
7 8 9		3 6 9		9 6 3	