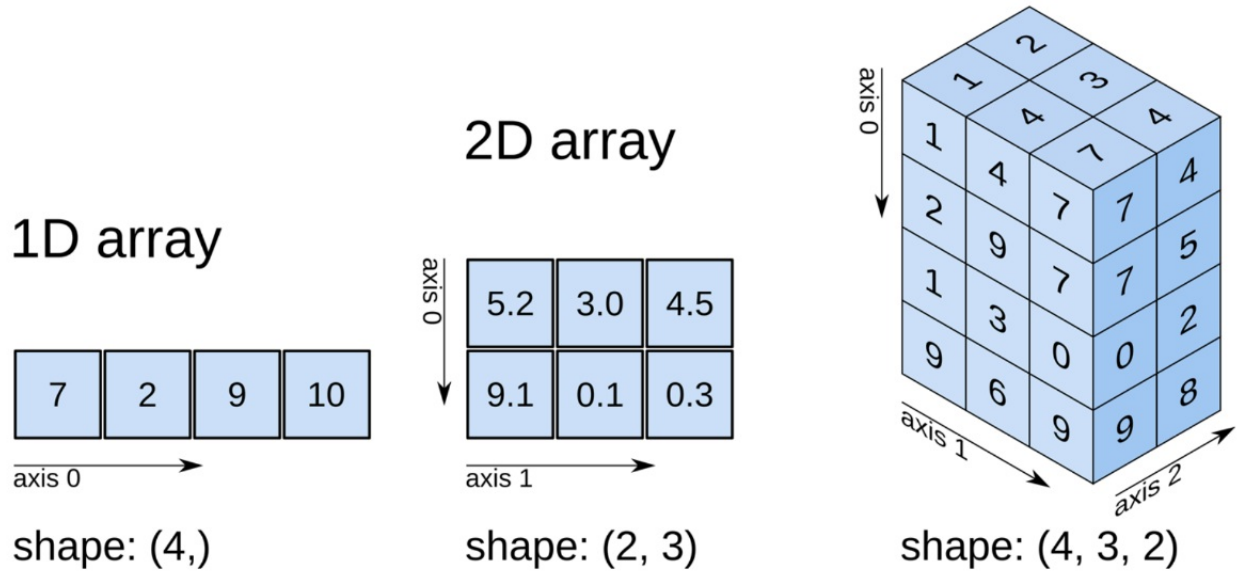
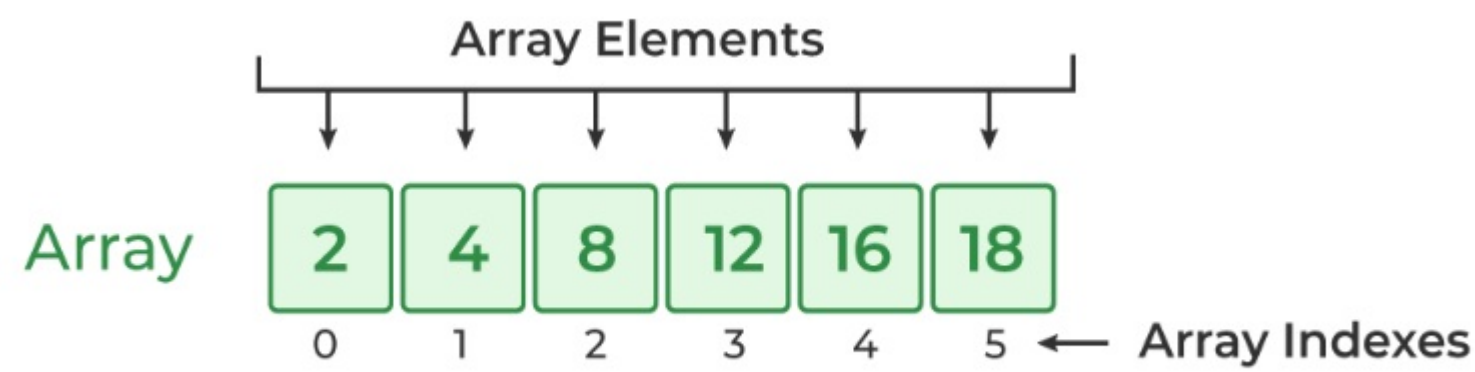


Implementation of 1D and Multi-Dimension Arrays


Array Elements
Array
2
4
8
12
16
18
0
1
2
3
4
5
Array Indexes

Problem 1: Insert Element at Index

Problem Statement:

Write a function to insert an element into a given array at a specified index.

```cpp
void insertAtIndex(int arr[], int &n, int value, int index);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Third line: Integer value to insert

Fourth line: Integer index where value is to be inserted

Output:

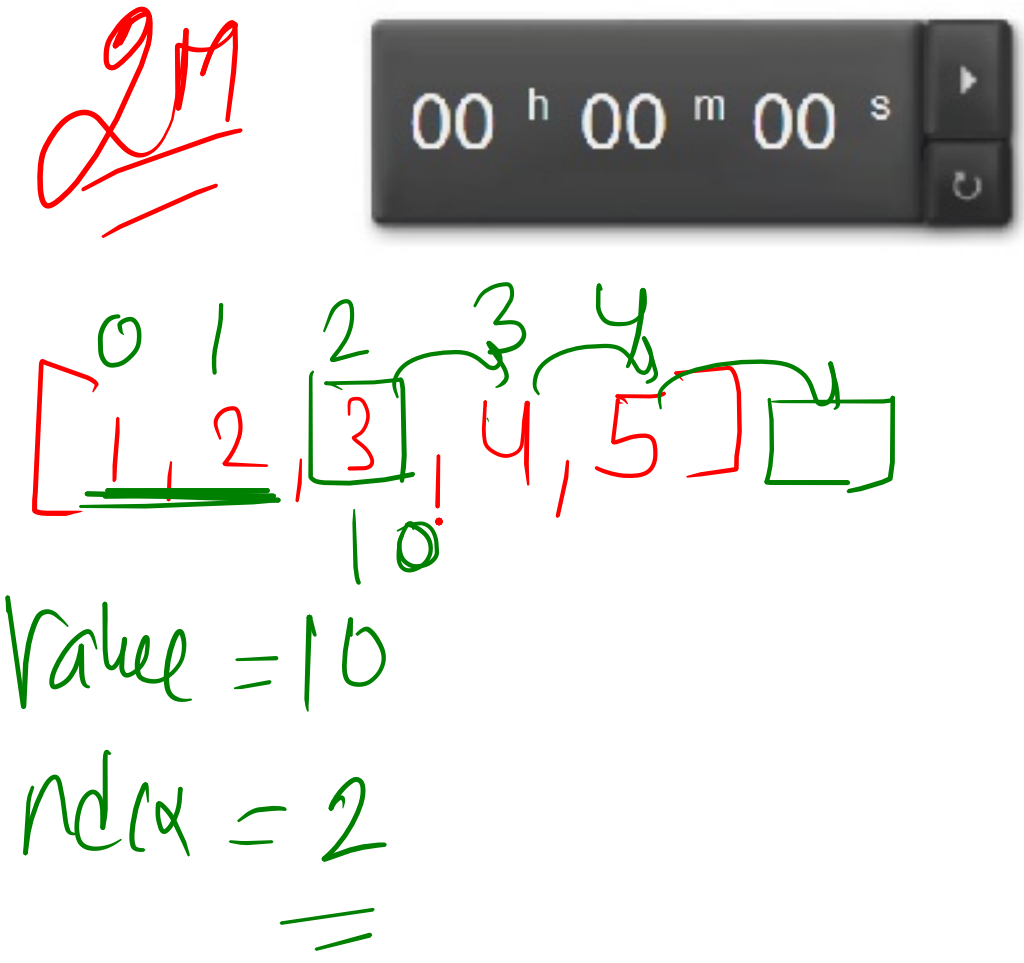
Print the array after insertion.

Sample Input:

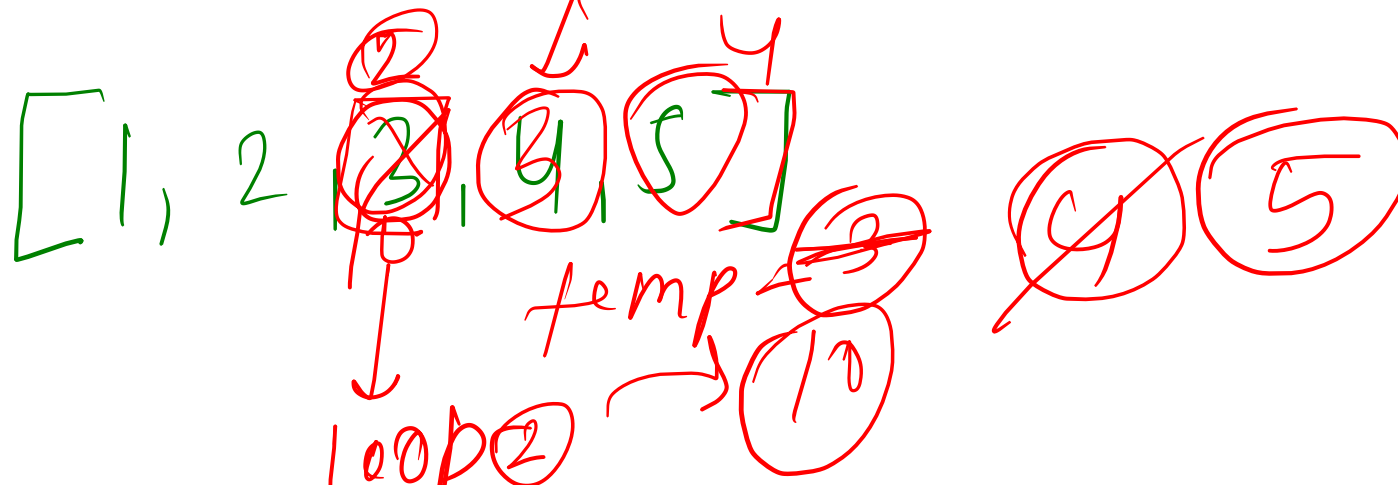
```
5
1 2 3 4 5
10
2
```

Sample Output:

```
1 2 10 3 4 5
```



Approach ①



Approach

Arr = [1, 2, 3, 4, 5]

Arr.push_back(0)

value = 10

index = 2

Array[index] = value

Problem 2: Delete Element at Index

Problem Statement:

Write a function to delete the element at a specified index from an array.

```cpp
void deleteAtIndex(int arr[], int &n, int index);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Third line: Integer index to delete

Output:

Print the array after deletion.

Sample Input:

```
6
10 20 30 40 50 60
3
```

Sample Output:

```
10 20 30 50 60
```

Problem 3: Update Negative Values to Positive

Problem Statement:

Write a function to update all negative elements in a given array by converting them to positive.

```cpp
void convertNegativesToPositive(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers (can include negative values)

Output:

Print the updated array where all negative values are converted to positive.

Sample Input:

```diff
6
-10 5 -3 8 0 -2
```

Sample Output:

```
10 5 3 8 0 2
```

Problem 4: Find Second Largest Element

Problem Statement:

Write a function to find the second largest element in a given array of distinct integers.

```cpp
int findSecondLargest(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n distinct integers

Output:

Print the second largest element.

Sample Input:

```
5
25 10 60 45 30
```

Sample Output:

```
45
```

L1 → for (n)) → max → 90

[1, 2, 60, 90, 10]

(n)

L2 for ( ) < 90 → 60

(2n)

n+n ⇒ 2n ⇒ O(n)

Problem 5: Move All Zeros to End

Problem Statement:

Write a function to move all 0s in the array to the end while maintaining the order of other elements.

```cpp
void moveZerosToEnd(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print the array after moving all 0s to the end.

Sample Input:

```
7
0 5 0 3 0 1 4
```

Sample Output:

```
5 3 1 4 0 0 0
```

Problem 6: Count Frequency of a Given Element

Problem Statement:

Write a function to count how many times a given number appears in the array.

```cpp
int countFrequency(int arr[], int n, int key);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Third line: Integer key to search for

Output:

Print the count of how many times the key appears.

Sample Input:

```
7
1 2 3 2 4 2 5
2
```

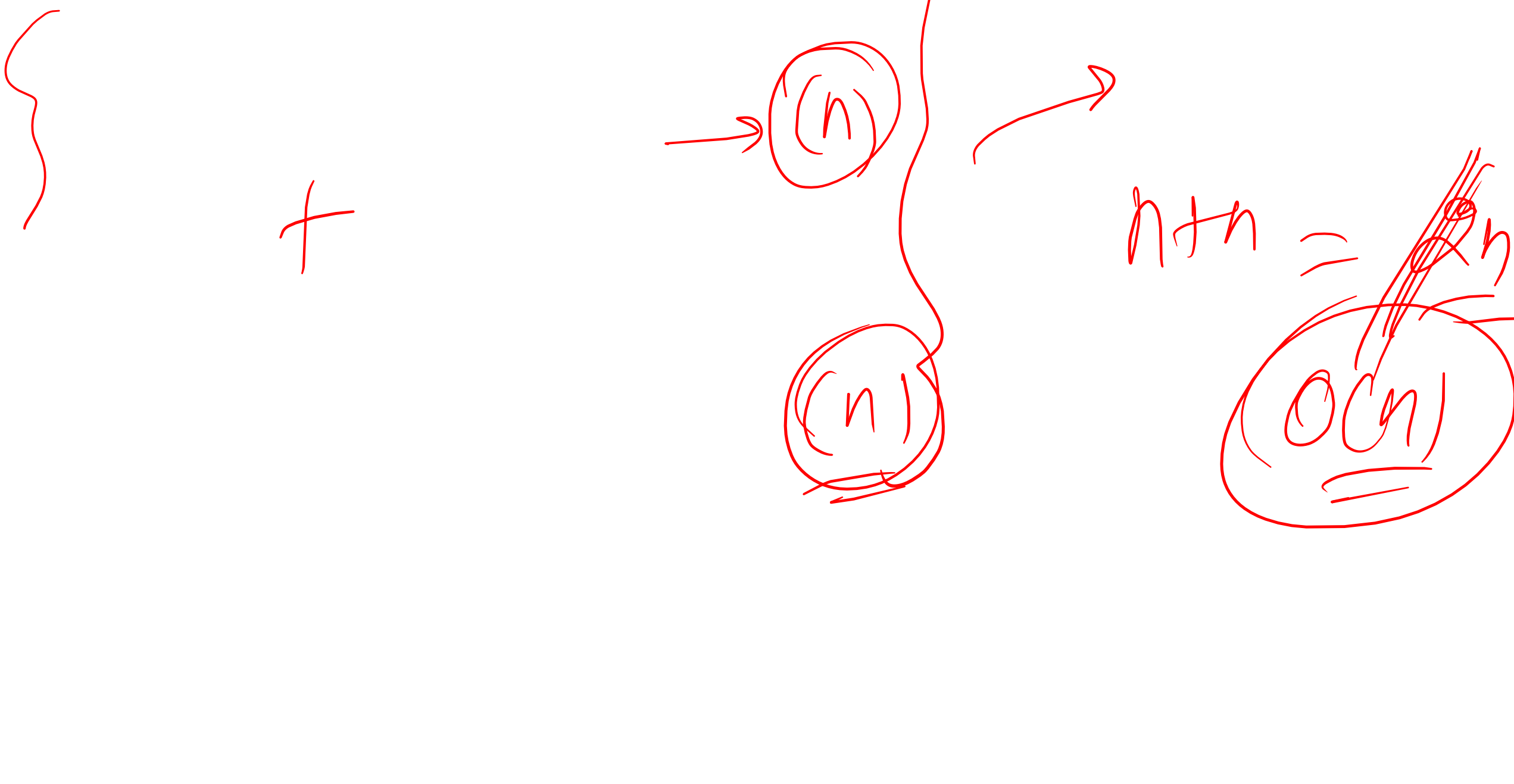
Sample Output:

```
3
```

Problem: Find the frequency of array elements

Array = [1, 2, 3, 2, 1, 3, 4, 5, 2]

take freqArr = [Array.size()] = {0}



Array = [1, 2, 3, 2, 1, 3, 4, 5, 2]

0 1 2 3 4 5 6 7 8

→ 9 element

temp = [1 2 2 1 0 0 0 0 0]

0 1 2 3 4 5 6 7 8

number

→ Approach

Problem 7: Check if Array is Sorted

Problem Statement:

Write a function to check if the given array is sorted in non-decreasing order.

```cpp
bool isSorted(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print "YES" if the array is sorted, otherwise print "NO".

Sample Input:

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

Sample Output:

```objectivec
YES
```

Ascending order

Problem 8: Rotate Array to the Right by One

Problem Statement:

Write a function to rotate the array elements to the right by one position.

```cpp
void rotateRightByOne(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print the array after rotating it right by one position.

Sample Input:

```
5
10 20 30 40 50
```

Sample Output:

```
50 10 20 30 40
```

Problem 9: Find First Repeating Element

Problem Statement:

Write a function to find and print the first repeating element in the array. If no element repeats, print -1.

```cpp
int findFirstRepeating(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print the first element that appears more than once. If no element repeats, print -1.

Sample Input:

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

Sample Output:

```
1
```

Problem 10: Find Number of Positive, Negative, and Zero Elements

Problem Statement:

Write a function to count how many positive, negative, and zero elements are in the array.

cpp Copy Edit

```cpp
void countPosNegZero(int arr[], int n, int &pos, int &neg, int &zero);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print three space-separated integers: count of positive, negative, and zero values.

Sample Input:

diff Copy Edit

```
7
-3 0 2 -1 0 4 -2
```

Sample Output:

Copy Edit

```
2 3 2
```

Problem 11: Frequency of Each Element

Problem Statement:

Write a function to find and print the frequency of **each unique element** in the given array.

Each element and its frequency should be printed only once.

cpp Copy Edit

```cpp
void printFrequencies(int arr[], int n);
```

Input:

First line: Integer `n` (number of elements)

Second line: `n` space-separated integers

Output:

Print each element and its frequency in the format:

`element: frequency`

Each element should be printed only once, in the order of their first appearance.

Sample Input:

Copy Edit

```
7
1 3 5 3 2 3 1
```

Sample Output:

makefile Copy Edit

```
1: 2
3: 3
5: 1
2: 1
```

Problem 12: Rotate Array by K Positions

Problem Statement:

Write a function to rotate the array to the right by `k` positions. The rotation should wrap around the array.

```cpp
void rotateRightByK(int arr[], int n, int k);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Third line: Integer k (number of positions to rotate)

Output:

Print the array after rotating it to the right by k positions.

Sample Input:

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

Sample Output:

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

Problem 13: Find Pair with Given Sum

Problem Statement:

Write a function to find any one pair of elements in the array whose sum is equal to a given target value.

```cpp
bool findPairWithSum(int arr[], int n, int target);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Third line: Integer target (sum to find)

Output:

If a pair exists, print the two numbers separated by space.

If no such pair exists, print -1.

Sample Input:

```
6
2 4 7 11 5 3
9
```

Sample Output:

```
4 5
```

Problem 14: Find Difference Between Max and Min

Problem Statement:

Write a function to find the difference between the maximum and minimum element in the array.

cpp Copy Edit

```cpp
int maxMinDifference(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print the difference (maximum - minimum)

Sample Input:

Copy Edit

```
5
10 20 5 8 30
```

Sample Output:

Copy Edit

```
25
```

Problem 15: Find Unique Elements (Appear Only Once)

Problem Statement:

Write a function to print all elements that appear only once in the array.

cpp Copy Edit

```cpp
void printUniqueElements(int arr[], int n);
```

Input:

First line: Integer n (number of elements)

Second line: n integers

Output:

Print all unique elements (elements that appear only once), separated by space.

Order of output should be the same as original input.

Sample Input:

Copy Edit

```
7
1 2 2 3 4 4 5
```

Sample Output:

Copy Edit

```
1 3 5
```

2D Dimension Array Impelmentation

Problem 1: Print 2D Vector Elements

Problem Statement:

Write a function to print all elements of a 2D vector in row-wise order.

```cpp
void print2DVector(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

Print the elements row-wise, each row on a new line.

Sample Input:

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

Sample Output:

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

Problem 2: Sum of All Elements in a 2D Vector

Problem Statement:

Write a function to return the sum of all elements in a 2D vector.

```cpp
int sum2DVector(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

Print the sum of all elements.

Sample Input:

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

Sample Output:

```
10
```

Problem 3: Sum of Two Matrices

Problem Statement:

Write a function to add two 2D matrices of the same size and store the result in a third matrix. Then print the resulting matrix.

```cpp
vector<vector<int>> addMatrices(const vector<vector<int>> &matrix1, const vector<vector<int>> &mat
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers of `matrix1`

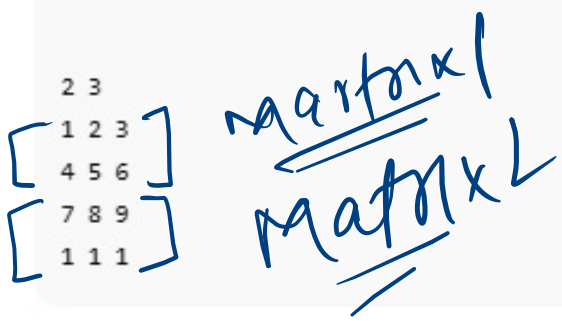
Next `rows` lines: Each line contains `cols` integers of `matrix2`

Output:

Print the resulting matrix after addition, row by row.

Sample Input:

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



Sample Output:

```
8 10 12
5 6 7
```

Problem 4: Row-wise and Column-wise Sum

Problem Statement:

Write a function to calculate and print the sum of each row and each column in a 2D matrix.

```cpp
void rowColWiseSum(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

First, print the sum of each row in separate lines.

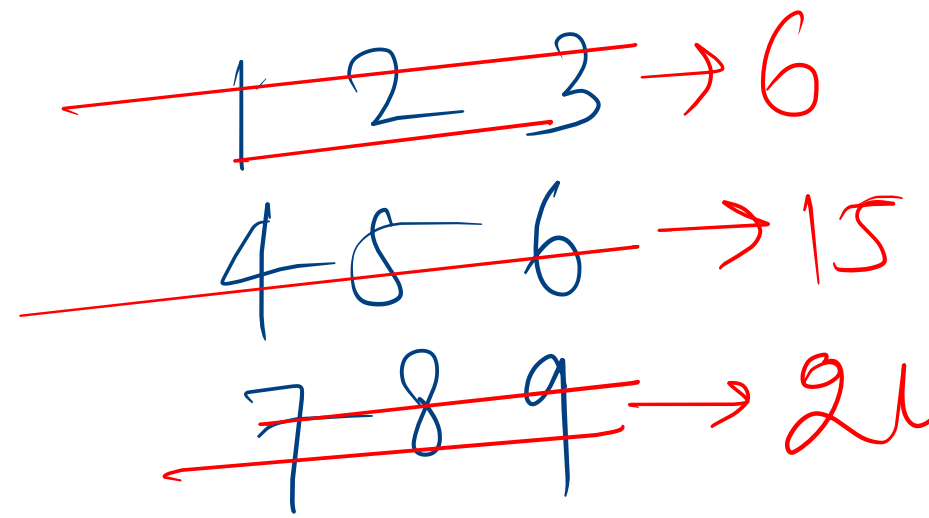
Then, print the sum of each column in one line, space-separated.

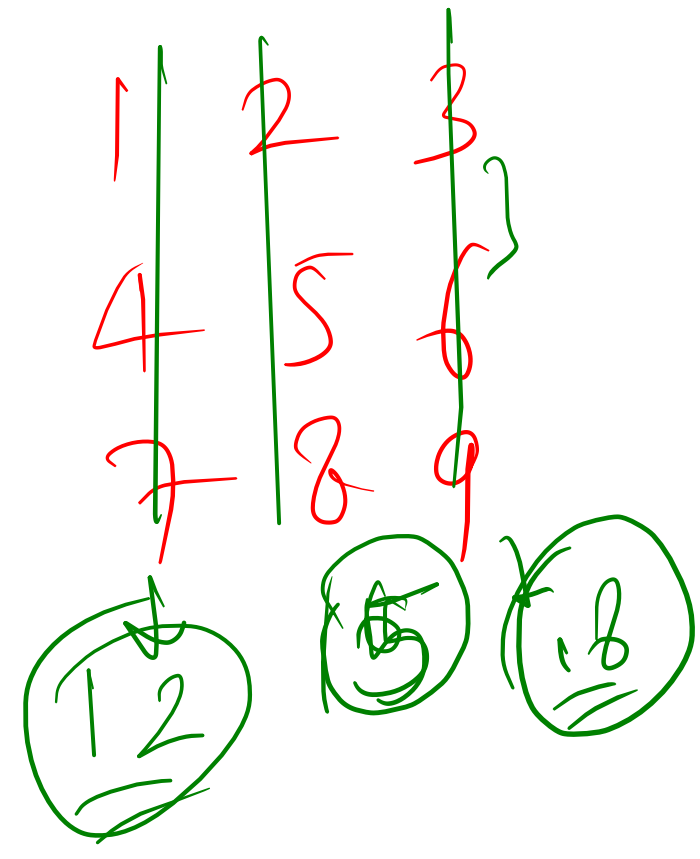
Sample Input:

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

Sample Output:

```sql
Row Sums:
6
15
24
Column Sums:
12 15 18
```





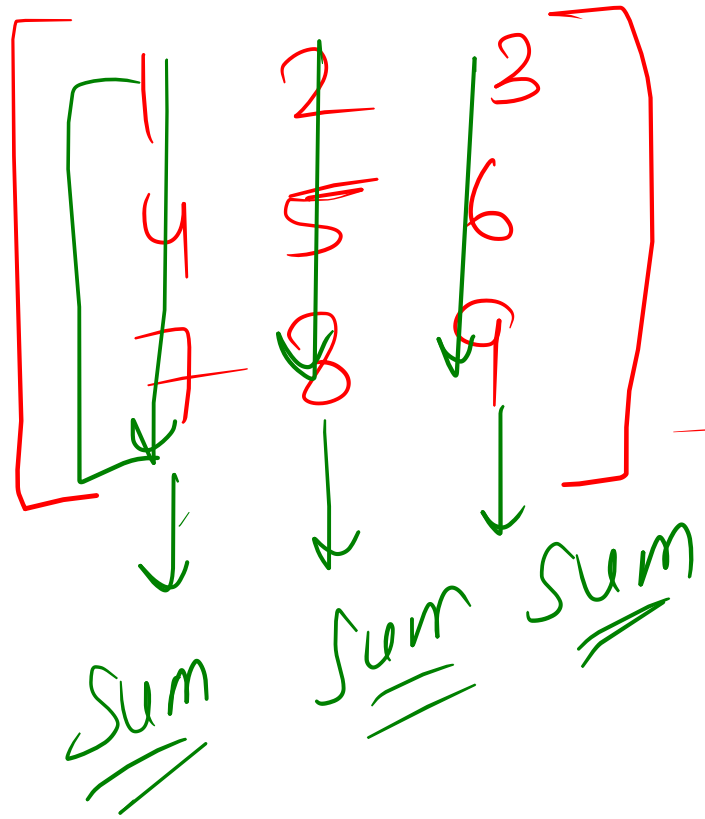
Arr = $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ → column

row wise

```
for(Row to rows)
{
    for (column to columns)
    {
        RowSum += Arr[i][j];
    }
}
```

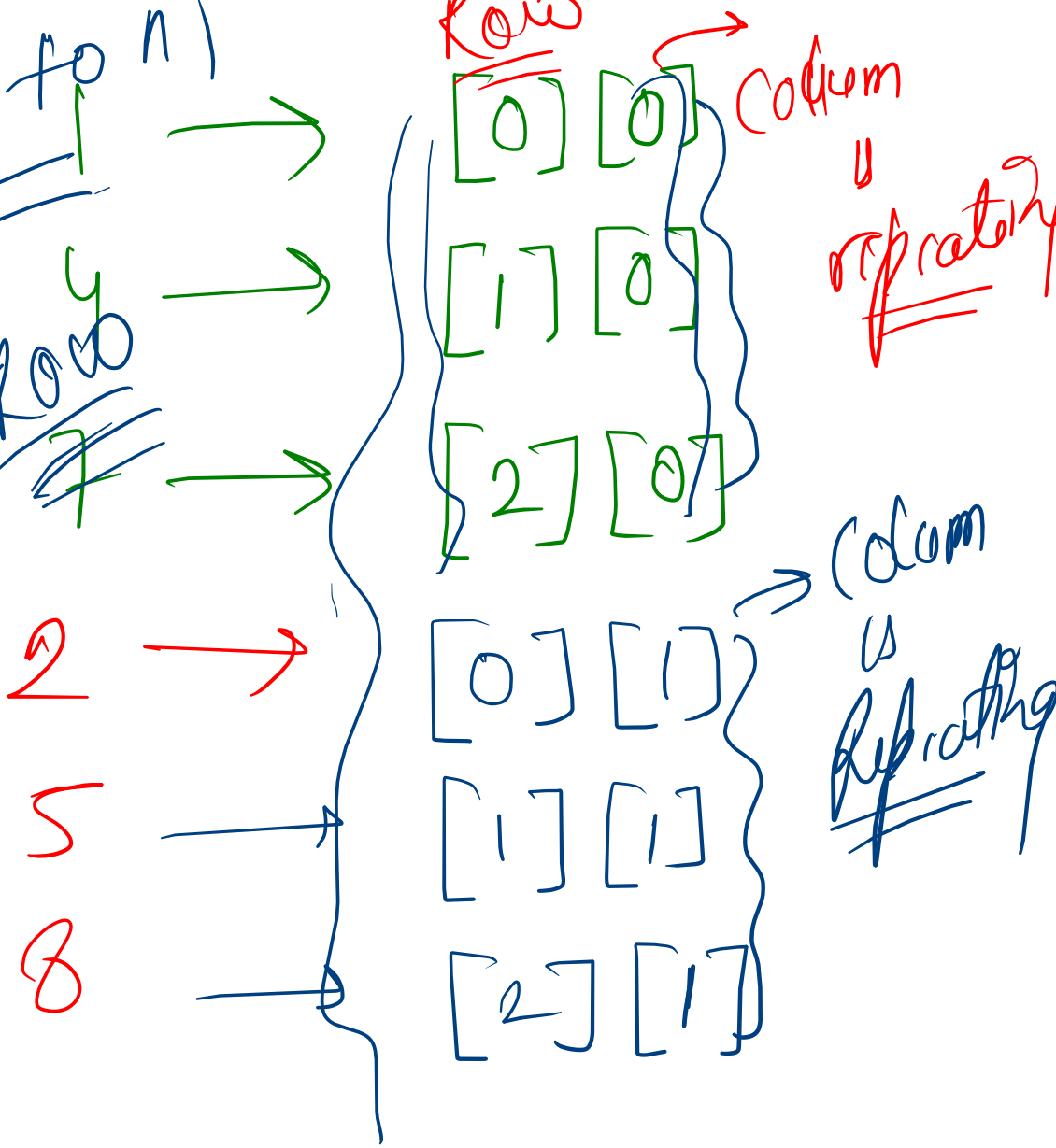
Column-wise sum

2D



for (colm to n)

for (row



Problem 5: Search an Element in 2D Vector

Problem Statement:

Write a function to search for a target element in a 2D vector and print its position if found. If not found, print `-1 -1`.

```cpp
void searchElement(const vector<vector<int>> &matrix, int target);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Next line: Integer `target`

Output:

Print the row and column index of the first occurrence of the target.

If not found, print `-1 -1`.

Sample Input:

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

Sample Output:

```
1 1
```

Problem 6: Normal Traversal of 2D Matrix

Problem Statement:

Write a function to traverse a 2D matrix in row-major order and return all elements as a 1D list.

```cpp
vector<int> normalTraversal(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

Print all elements in row-wise order in a single line, space-separated.

Sample Input:

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

Sample Output:

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

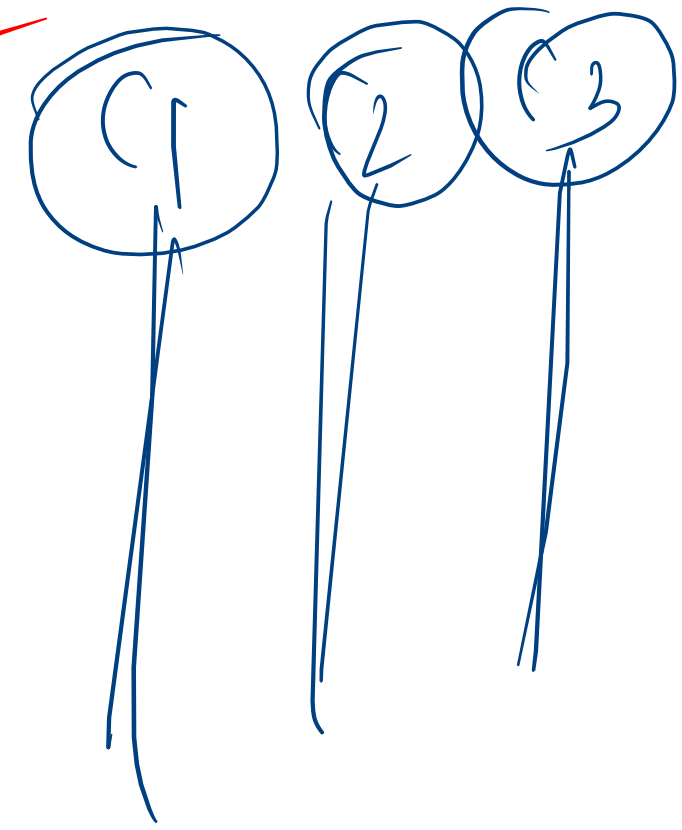
Matrix

(I) Row-major Order → Row by Row

(II) column-major order → column by column

Row-major order → 2d Array { row by row }

Column-major order



Problem 7: Transpose of a Matrix

Problem Statement:

Write a function to return the transpose of a given 2D matrix.

```cpp
vector<vector<int>> transposeMatrix(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

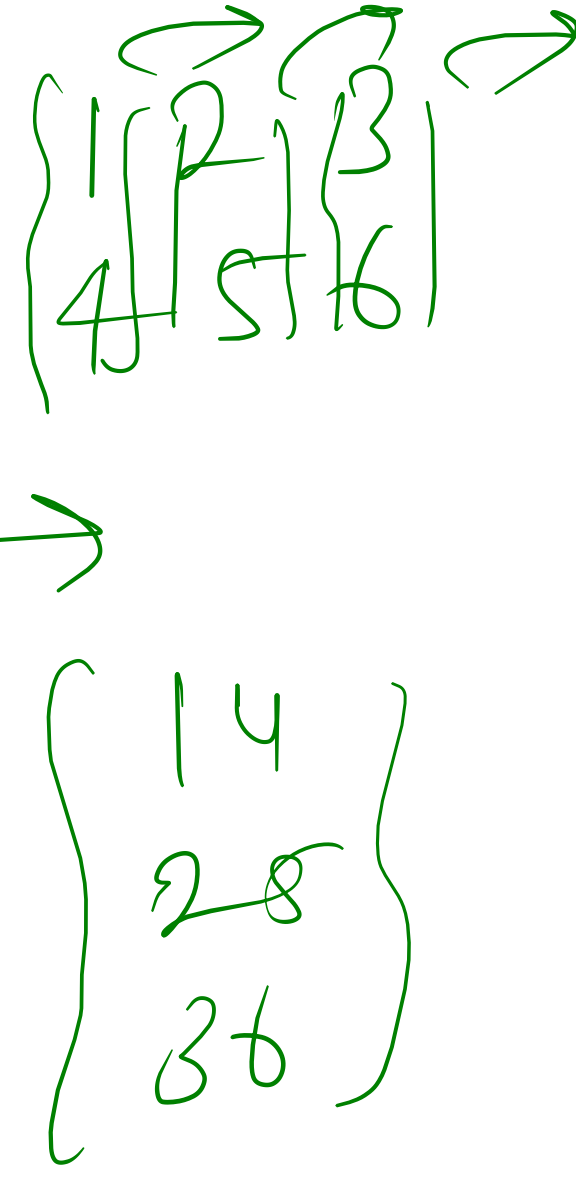
Print the transposed matrix.

Sample Input:

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

Sample Output:

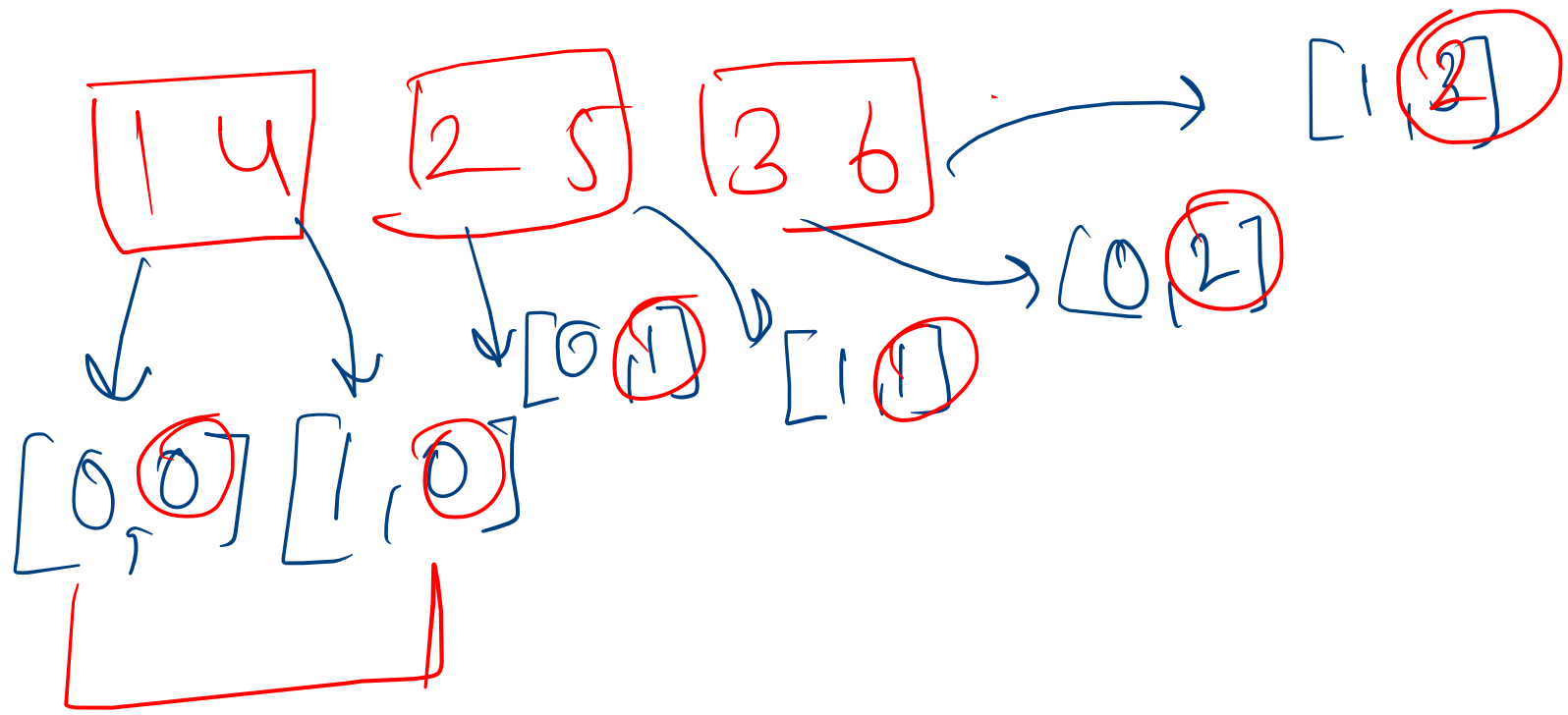
```
1 4
2 5
3 6
```



for (column)
for (row)

1 2 3
4 5 6

Column to Row
or
Row to column



Problem 8: Rotate Matrix by 90 Degrees Clockwise

Problem Statement:

Write a function to rotate a square matrix (n x n) by 90 degrees clockwise.

cpp Copy Edit

```cpp
void rotate90Clockwise(vector<vector<int>> &matrix);
```

Input:

First line: Integer `n` (rows and columns, square matrix)

Next `n` lines: Each line contains `n` integers

Output:

Print the matrix after rotating it 90 degrees clockwise.

Sample Input:

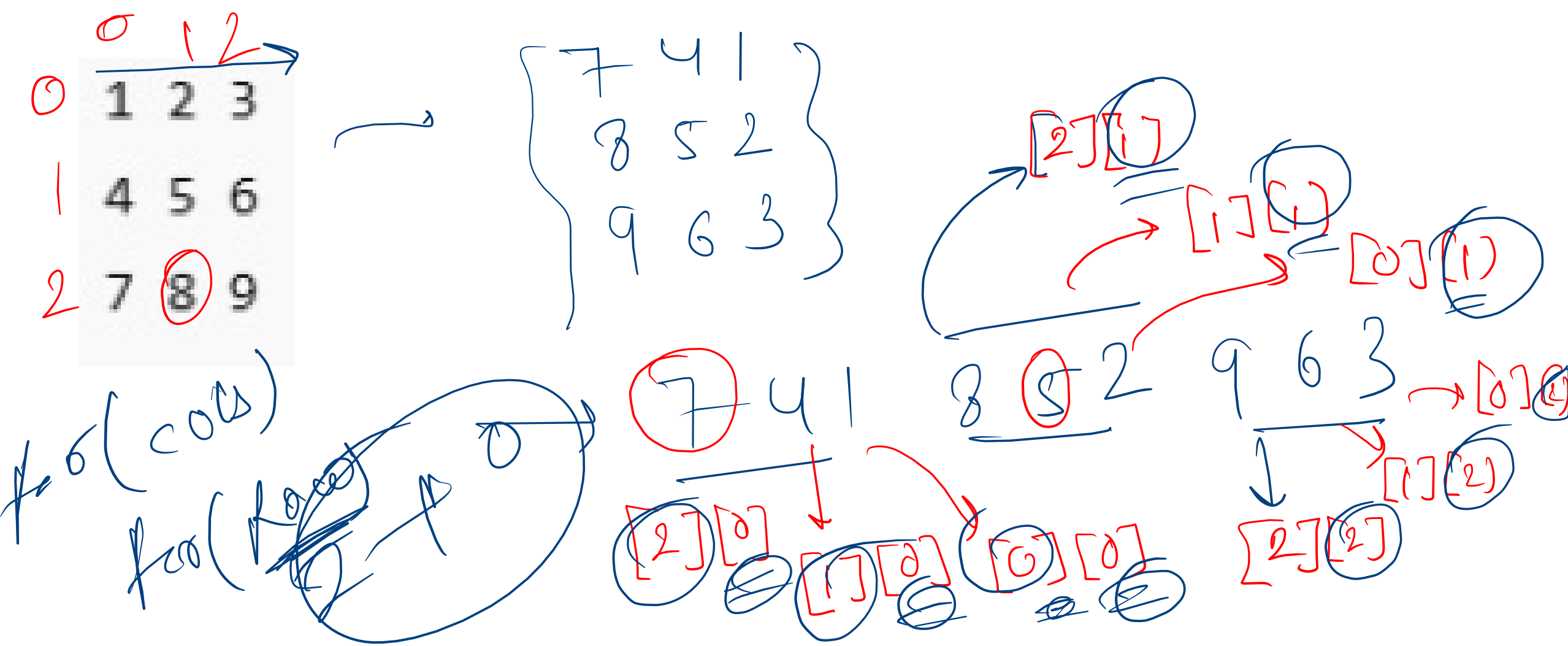
Copy Edit

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

Sample Output:

Copy Edit

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


0 1 2
0 1 2 3
1 4 5 6
2 7 8 9
7 4 1
8 5 2
9 6 3
[2][1]
[1][1]
[0][1]
8 5 2
9 6 3
[0][0]
[1][2]
[2][2]
7 4 1
[2][0]
[1][0]
[0][0]
for(col)
for(row)

Problem 9: Print Diagonal Elements

Problem Statement:

Write a function to print the **main diagonal** and **secondary diagonal** elements of a square matrix.

cpp Copy Edit

```cpp
void printDiagonals(const vector<vector<int>> &matrix);
```

Input:

First line: Integer `n` (for n x n matrix)

Next `n` lines: Each line contains `n` integers

Output:

First line: Main diagonal elements

Second line: Secondary diagonal elements

Sample Input:

Copy Edit

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

Sample Output:

Copy Edit

```
1 5 9
3 5 7
```

1 2 3

4 5 6

7 8 9

Right →

1 5 9

[0][0] [1][1] [2][2]

1==1

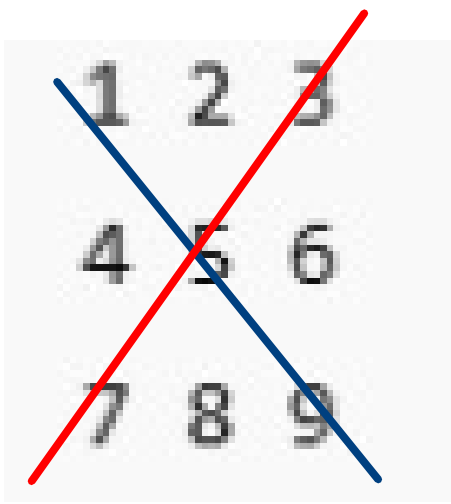
[

Left →

3 5 7

[0][2] [1][1] [2][0]

cross / Left



main / Right

Problem 10: N Traversal of Matrix

Problem Statement:

Write a function to print the elements of a square matrix in an **N pattern traversal:**

- Print the first column from top to bottom
- Then print the diagonal from bottom-left to top-right
- Then print the last column from top to bottom

cpp Copy Edit

```cpp
void nTraversal(const vector<vector<int>> &matrix);
```

Input:

First line: Integer `n` (for an `n x n` matrix)

Next `n` lines: Each line contains `n` integers

Output:

Print the elements in N pattern, space-separated.

Sample Input:

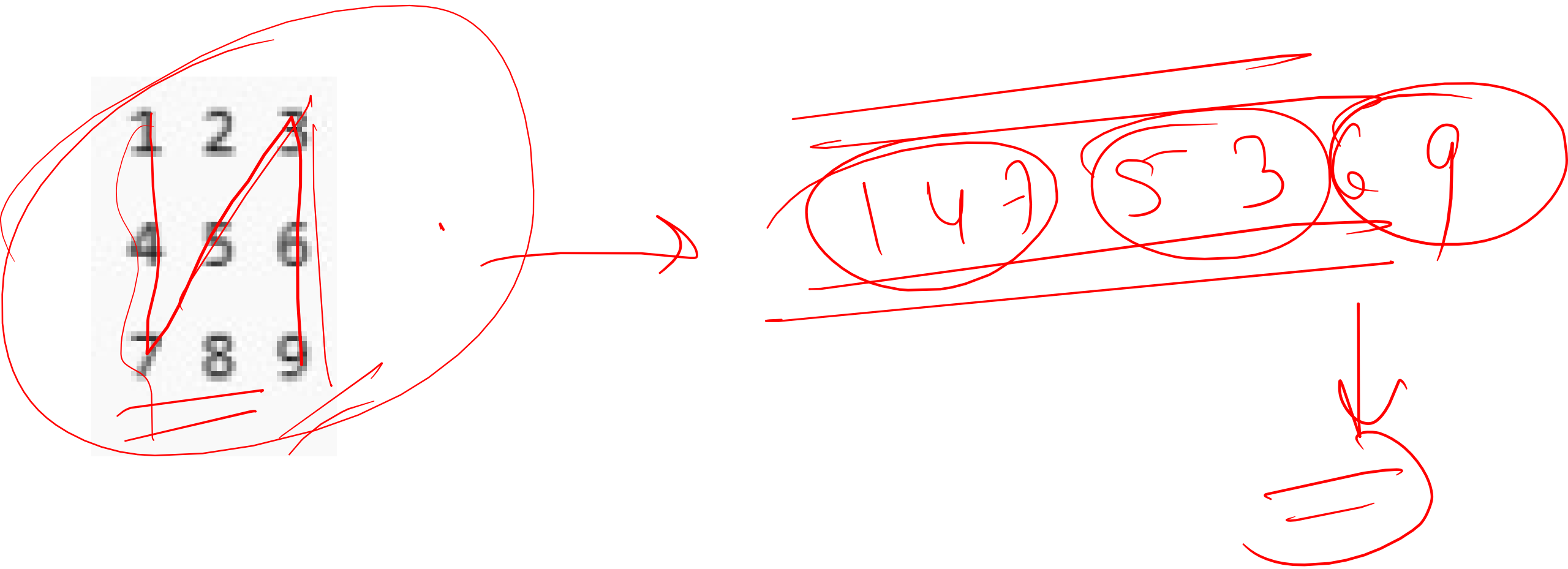
Copy Edit

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

Sample Output:

Copy Edit

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


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

Updated Problem 11: Spiral Traversal (Anti-clockwise)

Problem Statement:

Write a function to traverse a 2D matrix in **anti-clockwise spiral order**, starting from the top-left corner and moving **down first.**

```cpp
vector<int> spiralTraversalAntiClockwise(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

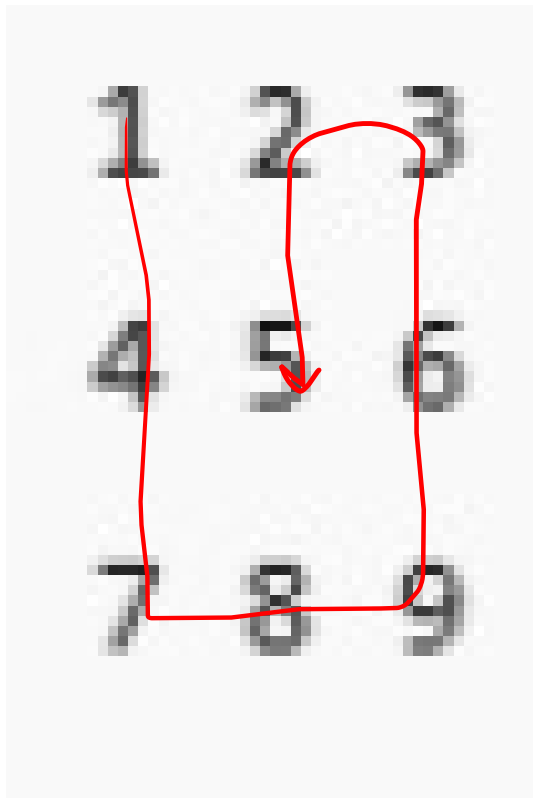
Print the elements in anti-clockwise spiral order, space-separated.

Sample Input:

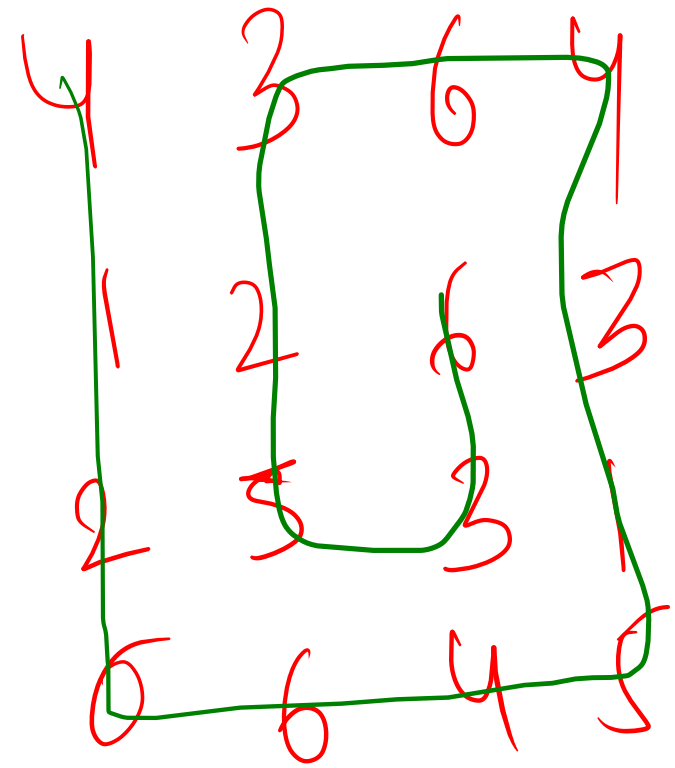
```
3 3
1 2 3
4 5 6
7 8 9
```

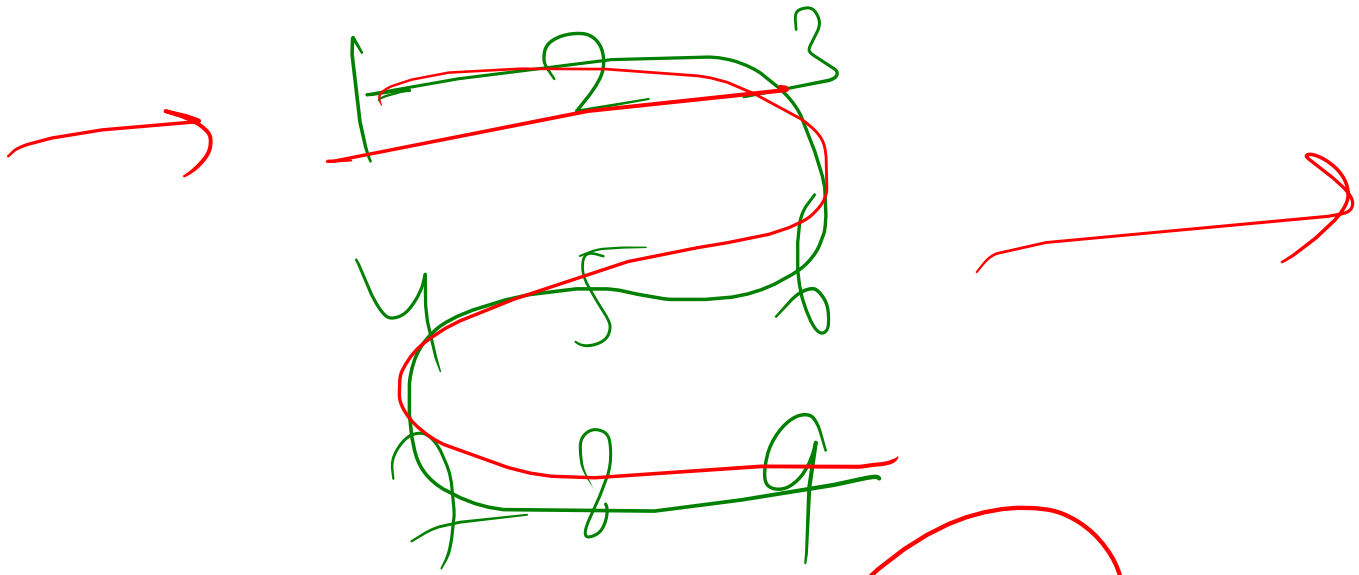
Sample Output:

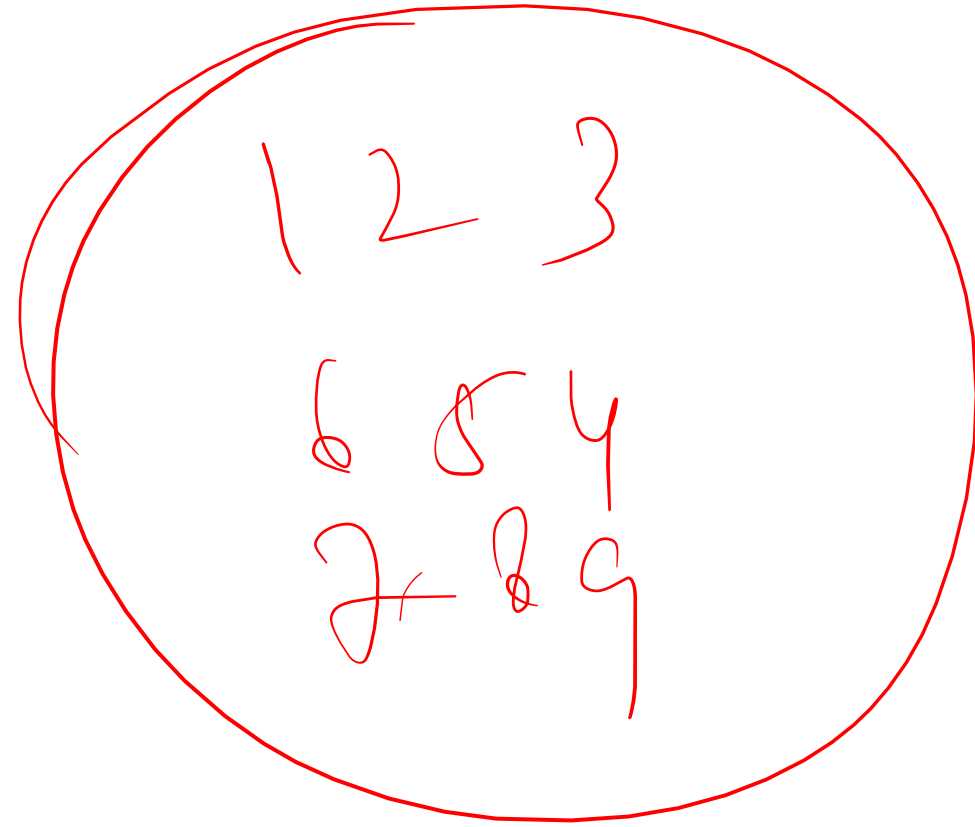
```
1 4 7 8 9 6 3 2 5
```

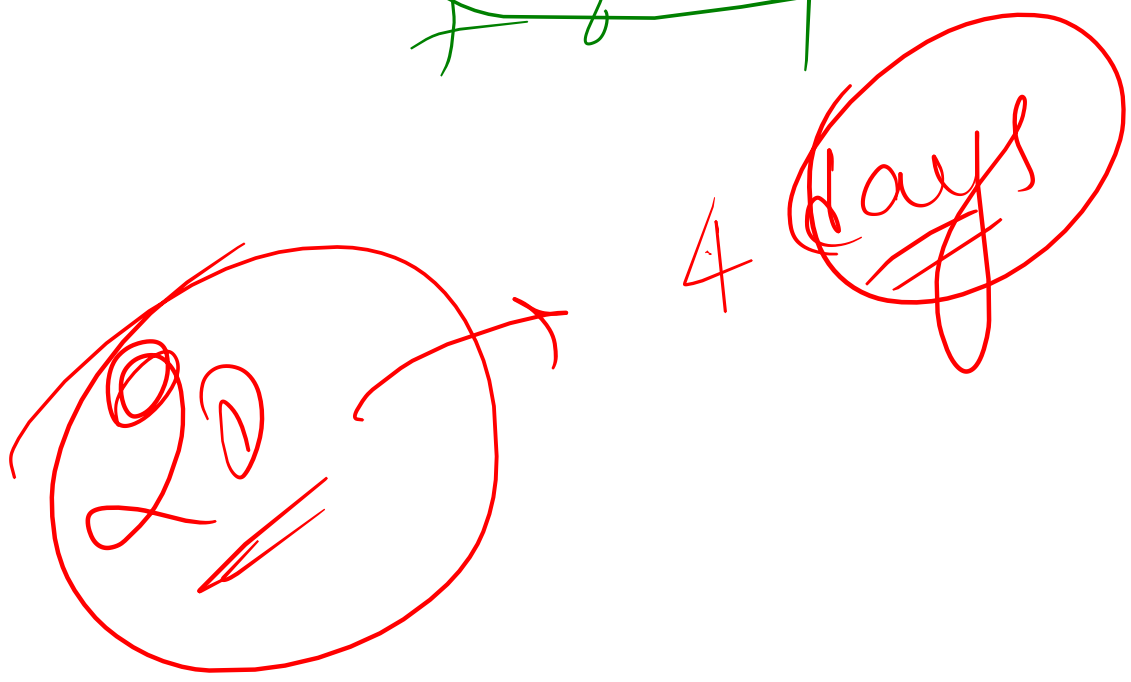


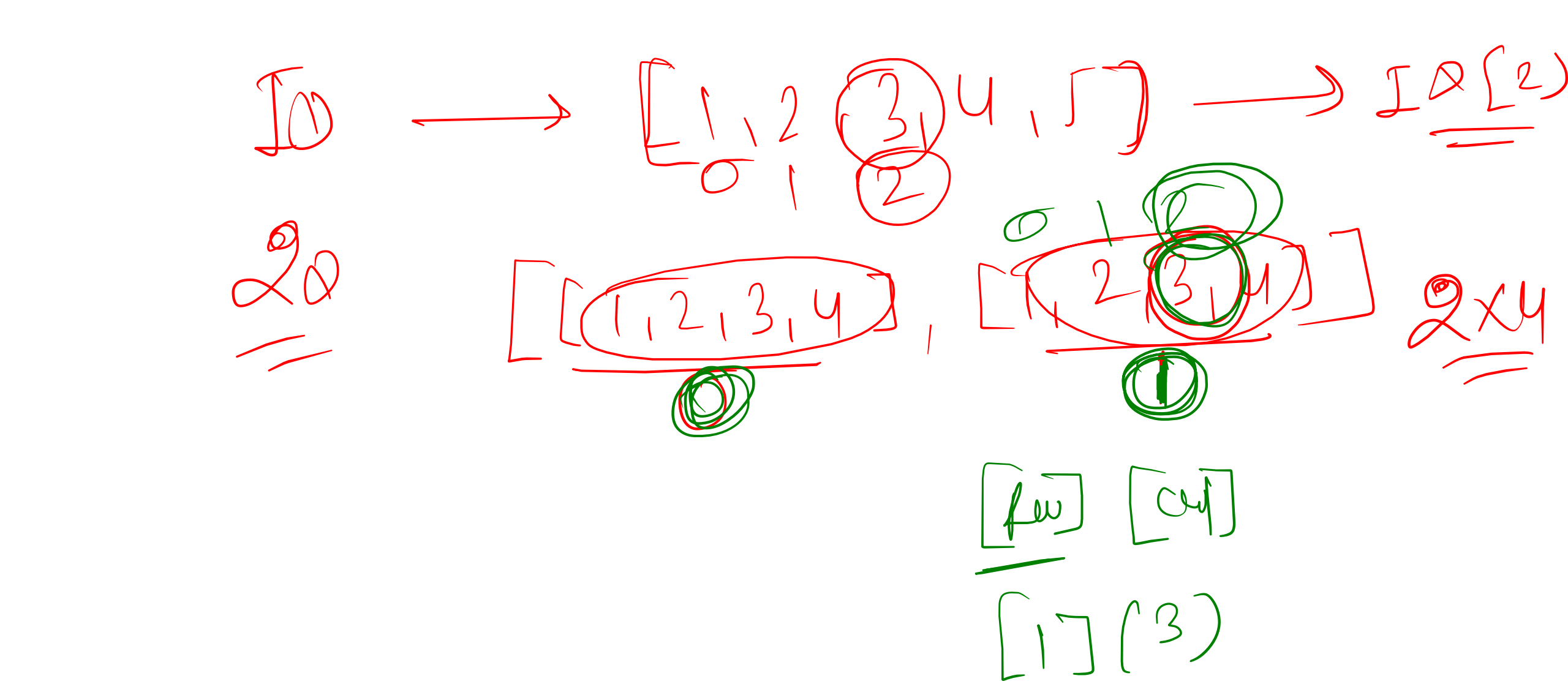
3x3






1 2 3
6 5 4
7 8 9


4 days


[1,2,3,4,5]
[1,2,3,4]
[1,2,3,4]
2D
2x4
[5]
[1]

3D

2D

2D

[[[1 2 3] [1 0 3]] [[4 5 6] [4 5 6]]]

[0] [1] [1]

for ( )

for ( )
for

for
for
for

Problem 12: Print Matrix in Zig-Zag Order

Problem Statement:

Write a function to print a 2D matrix in **zig-zag row-wise order**:

- Even-indexed rows (0, 2, ...) → left to right
- Odd-indexed rows (1, 3, ...) → right to left

cpp Copy Edit

```cpp
void zigZagTraversal(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

Print the zig-zag traversal elements in a single line.

Sample Input:

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```
3 4
1 2 3 4
5 6 7 8
9 10 11 12
```

Sample Output:

Copy Edit

```
1 2 3 4 8 7 6 5 9 10 11 12
```

Problem 13: Boundary Traversal of Matrix

Problem Statement:

Write a function to print the **boundary elements** of a matrix in a clockwise manner, starting from the top-left corner.

```cpp
void boundaryTraversal(const vector<vector<int>> &matrix);
```

Input:

First line: Two integers `rows` and `cols`

Next `rows` lines: Each line contains `cols` integers

Output:

Print the boundary elements in clockwise order.

Sample Input:

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

Sample Output:

```
1 2 3 4 8 12 16 15 14 13 9 5
```

End