1-Problem Statement – Spiral Traversal of a Matrix

```
#include <iostream>
using namespace std;

int main() {
    int row, col;
    cout << "Enter the number of rows: ";
    cin >> row;
    cout << "Enter the number of columns: ";
    cin >> col;

    int spiral[row][col];

    for (int i = 0; i < row; i++) {
        for (int j = 0; j < col; j++) {
            cout << "Enter the element of " << i << ", " << j << " = ";
            cin >> spiral[i][j];
        }
    }

    int startrow = 0;
int endrow = row - 1;
int startcol = 0;
int endcol = col - 1;

cout << "Spiral order matrix:" << endl;

while (startrow <= endrow && startcol <= endcol) {
    for (int i = startcol; i <= endcol; i++) {
        cout << spiral[startrow][i] << " ";
    }
    startrow++;

    for (int j = startrow; j <= endrow; j++) {
        cout << spiral[j][endcol] << " ";
    }
    endcol--;

    if (startrow <= endrow) {
        for (int i = endcol; i >= startcol; i--) {
            cout << spiral[endrow][i] << " ";
        }
```

```
            endrow--;
        }

        if (startcol <= endcol) {
            for (int j = endrow; j >= startrow; j--) {
                cout << spiral[j][startcol] << " ";
            }
            startcol++;
        }
    }

    return 0;
}
```

Input:

```
Enter the number of rows: 3
Enter the number of columns: 3
Enter the element of 0, 0 = 1
Enter the element of 0, 1 = 2
Enter the element of 0, 2 = 3
Enter the element of 1, 0 = 4
Enter the element of 1, 1 = 5
Enter the element of 1, 2 = 6
Enter the element of 2, 0 = 7
Enter the element of 2, 1 = 8
Enter the element of 2, 2 = 9
Output:
Spiral order matrix:
1  2 3 6 9 8 7 4 5
```

2 - Problem Statement – Transpose of a Matrix

```
#include <iostream>
using namespace std;

int main()
{
    int row, col;
    cout << "Enter the number of rows: ";
    cin >> row;
    cout << "Enter the number of columns: ";
    cin >> col;
    int arr[100][100];
    for (int i = 0; i < row; i++)
    {
        for (int j = 0; j < col; j++)
        {
            cout<<"Enter the value at "<<i<<" row "<<j<<" coulmn: ";
            cin>> arr[i][j];
        }
    }
    for (int j = 0; j < col; j++)
    {
        for (int i = 0; i < row; i++)
        {
            cout << arr[i][j] << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Input:

```
Enter the number of rows: 3
Enter the number of columns: 3

Enter the value at 0 row 0 coulmn: 1

Enter the value at 0 row 1 coulmn: 2

Enter the value at 0 row 2 coulmn: 3

Enter the value at 1 row 0 coulmn: 4

Enter the value at 1 row 1 coulmn: 5

Enter the value at 1 row 2 coulmn: 6

Enter the value at 2 row 0 coulmn: 7

Enter the value at 2 row 1 coulmn: 8

Enter the value at 2 row 2 coulmn: 9

Output:

1 4 7

2 5 8

3 6 9
```

3 - Problem Statement – Rotate Matrix by 90° Clockwise

```
#include <iostream>

using namespace std;


int main()

{

    int n;
```

```
cout << "Enter the size : ";
cin >> n;
int arr[100][100], rotated[100][100];

for (int i = 0; i < n; i++)
{
    for (int j = 0; j < n; j++)
    {
        cout << "Enter the value at " << i << " row " << j << " column: ";
        cin >> arr[i][j];
    }
}
for (int i = 0; i < n; i++)
{
    for (int j = 0; j < n; j++)
    {
        rotated[j][n - 1 - i] = arr[i][j];
    }
}
cout << "Matrix after 90 degree clockwise rotation:" << endl;
for (int i = 0; i < n; i++)
```

```
    {
        for (int j = 0; j < n; j++)
        {
            cout << rotated[i][j] << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Input:

```
Enter the size : 3
Enter the value at 0 row 0 column: 1
Enter the value at 0 row 1 column: 2
Enter the value at 0 row 2 column: 3
Enter the value at 1 row 0 column: 4
Enter the value at 1 row 1 column: 5
Enter the value at 1 row 2 column: 6
Enter the value at 2 row 0 column: 7
Enter the value at 2 row 1 column: 8
Enter the value at 2 row 2 column: 9
Ouput:
Matrix after 90 degree clockwise rotation:
7 4 1
8 5 2
9 6 3
```

4- Problem Statement – Wave Form Traversal

```
#include <iostream>
using namespace std;

int main()
{
   int N, M;
   cout<<"Enter the number of rows: ";
   cin>> N;
   cout<< "Enter the number of column: ";
   cin>> M;
   int arr[100][100];
   for (int i = 0; i < N; i++)
   {
    for (int j = 0; j < M; j++)
    {
        cout<<"Enter the value at "<<i<<" row "<<j<<" column: ";
        cin >> arr[i][j];
    }
}
for (int j = 0; j < M; j++)
{
    if (j % 2 == 0)
    {
        for (int i = 0; i < N; i++)
        {
            cout << arr[i][j] << " ";
        }
    }
    else
    {
        for (int i = N - 1; i >= 0; i--)
        {
            cout << arr[i][j] << " ";
        }
        }
    }

    return 0;
}
```

Input:

```
Enter the number of rows: 3
Enter the number of column: 3
Enter the value at 0 row 0 column: 1
Enter the value at 0 row 1 column: 2
Enter the value at 0 row 2 column: 3
Enter the value at 1 row 0 column: 4
Enter the value at 1 row 1 column: 5
Enter the value at 1 row 2 column: 6
Enter the value at 2 row 0 column: 7
Enter the value at 2 row 1 column: 8
Enter the value at 2 row 2 column: 9
```

Output:

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