2D Arrays

↳ Matrix (Rows, Coloumn)

$$\begin{array}{c|cccc}
 & (0,0) & (0,1) & (0,2) & (0,3) \\
\hline
R_1 & 1 & 2 & 3 & 4 \\
R_2 & 5 & 6 & 7 & 8 \\
R_3 & 9 & 10 & 11 & 12 \\
R_4 & 13 & 14 & 15 & 16 \\
\hline
 & (4,1) & (4,2) & (4,3) & (4,4) \\
 & C_1 & C_2 & C_3 & C_4
\end{array}$$

→ Creating / Declaring

int matrix [rows] [cols]

int matrix [4] [4]

Printing specific Index

matrix [4] [1]

Printing all elements / Taking all elements

```
for(i=0; i<rows ; i++){ —— rows
    for(j=0; j<cols; j++){ —— coloumn
        matrix[rows][cols]
```

→ 2D Array in Memory

Simple Array

$$A = \begin{array}{|c|c|c|c|c|c|}
\hline
1 & 2 & 3 & 4 & 5 & 6 \\
\hline
\end{array}$$

$$\begin{array}{cccccc l}
0 & 1 & 2 & 3 & 4 & 5 & \text{— Indexes} \\
1111 & 2222 & 333 & 444 & 555 & 666 & \text{— Memory Addresses}
\end{array}$$

2-D Arrays

Row Major →

$$\begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 & 16 \\
\hline
\end{array}$$

Coloumn Major →

$$\begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline
1 & 5 & 9 & 13 & 2 & 6 & 10 & 14 & 3 & 7 & 11 & 15 & 4 & 8 & 12 & 16 \\
\hline
\end{array}$$

• → linear Search

```
key = ? — given by user.
for(i=0; i<rows; i++){
  for(j=0; j<cols; j++){
      key = matrix[i][j]
        return True
  else False
```

• → Max Row Sum :— maxRowSum = 0

```
for(i=0; i<rows; i++){
   for(j=0; j<cols; j++){    → rowSum = 0
      rowSum += matrix[i][j]
   }
   MaxRowSum = max(maxRowSum, RowSum)
```

• → Diagonal Sum

```
  for(i = 0; i<rows ; i++){
  for(j=0; j<cols; j++){
       if(i==j){
         sum+= matrix[i][j]
       else if (j = n-i-1)
         sum+= matrix[i][j]
```

→ 2D Vectors

↳ dynamic (can be changed at the runtime) —. Used in the place of 2-D Arrays.

For declaring → vector<vector<int>> matr =
{{1,2,3}, {4,5,6}, {7,8,9}, {10,11,12}}

Same loops run for the user Input or Printing purposes but here are:

```
rows = mat.size()
cols = mat[i].size()
```

As the vectors are dynamic, So the Number of rows and number of coloumns might not be the same aswell.