#include <stdio.h>

#include<stdlib.h>

int \*\* createMatrix(int row,int col){

int \*\* mat = (int \*\*) malloc(sizeof(int\*)\*row);

for(int i=0;i<row;i++){

\*(mat+i) = (int \*)malloc(sizeof(int)\*col);

}

return mat;

}

void getValue(int \*\* mat,int row,int col){

printf("Enter the Values\n");

for(int i=0;i<row;i++){

for(int j=0;j<col;j++){

scanf("%d",\*(mat+i)+j);

}

}

}

void printMatrix(int \*\* mat,int row,int col){

printf("the Value inside the matrix are:\n");

for(int i=0;i<row;i++){

for(int j=0;j<col;j++){

printf("%d ",\*(\*(mat+i)+j));

}

printf("\n");

}

}

int checkLowerTriangularMatrix(int \*\* mat,int row,int col){

for(int i=0;i<row;i++){

for(int j=0;j<col;j++){

if(j>i && mat[i][j]!=0){

return 0;

}

}

}

return 1;

}

int checkUpperTriangularMatrix(int \*\* mat,int row,int col){

for(int i=0;i<row;i++){

for(int j=0;j<col;j++){

if(j<i && mat[i][j]!=0){

return 0;

}

}

}

return 1;

}

int sumOfMatrix(int \*\* mat,int row,int col){

int sum = 0;

for(int i=0;i<row;i++){

for(int j=0;j<col;j++){

sum = sum+mat[i][j];

}

}

return sum;

}

void printArray(int \* arr,int size){

for(int i=0;i<size;i++){

printf("%d ",\*(arr+i));

}

printf("\n");

}

int \* createArray(int size){

return (int \*)malloc(sizeof(int)\*size);

}

int \* colSum(int \*\* mat,int row,int col){

int \* res = createArray(col);

int sum = 0;

for(int j=0;j<col;j++){

sum = 0;

for(int i=0;i<row;i++){

sum = sum+mat[j][i];

}

\*(res+j) = sum;

}

}

int \* rowSum(int \*\* mat,int row,int col){

int \* res = createArray(row);

int sum = 0;

for(int i=0;i<row;i++){

sum = 0;

for(int j=0;j<col;j++){

sum = sum+mat[i][j];

}

\*(res+i) = sum;

}

}

int main(void) {

int row,col;

int \*\* mat;

printf("Enter the row and cols value\n");

scanf("%d%d",&row,&col);

//int mat[row][col]; // Static memory allocation

mat = createMatrix(row,col);

getValue(mat,row,col);

printMatrix(mat,row,col);

if(checkLowerTriangularMatrix(mat,row,col)){

printf("The Given Matrix is a Lower Traingular Matrix\n");

printf("The sum of given Lower triangular Matrix is : %d\n",sumOfMatrix(mat,row,col));

} else {

printf("The Give Matrix is not a Lower Traingular Matrix\n");

}

if(checkUpperTriangularMatrix(mat,row,col)){

printf("The Give Matrix is a Upper Traingular Matrix\n");

printf("The sum of given Upper triangular Matrix is : %d\n",sumOfMatrix(mat,row,col));

} else {

printf("The Give Matrix is not a Upper Traingular Matrix:\n");

}

int \* rowSumArr = rowSum(mat, row, col);

printf("The row sum of the given matrix is:\n");

printArray(rowSumArr, row);

int \* colSumArr = colSum(mat, row, col);

printf("The col sum of the given matrix is:\n");

printArray(colSumArr, col);

return 0;

}

