Objective:

- Creating and manipulating 2D arrays on heap.
- Use of alias and pointers together.

Given to PF – SE-F17

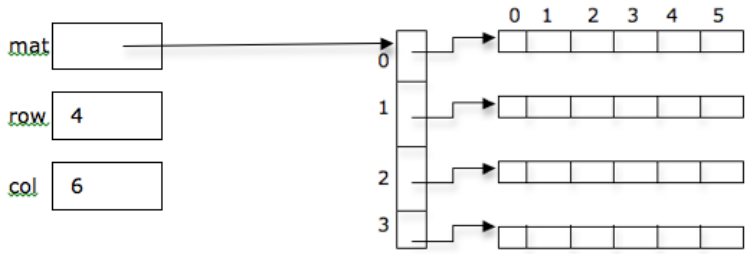
Problem – 1: *Matrix*

In this problem, our goal is to design a library, which will support basic operations of Matrices. The supported operations in this library will be as follows.

Data Structure used for this problem will be as follows:

```
int rows = 4;
int cols = 6;
int * * mat;

mat = new int * [ rows ];
for ( int i=0; i < rows; i = i + 1 )
{
      mat [i] = new int [cols];
}
```



Supported Operations:

1. `void createMatrix (int * * & m, int row=1, int Col=1);`
2. `int& at(int * * & p, int r, int c);`
   For setting or getting some value at a particular location of matrix
3. `void printMatrix(int * * & p, int rows, int cols)`
4. `int isIdentity (int * * & p, int rows, int cols)`
   if aij = 0 for i != j and aij = 1 for all i = j.
5. `bool isLowerTriangular (int * * & p, int rows, int cols)`
6. `bool isUpperTriangular (int * * & p, int rows, int cols)`
7. `bool isTriangular (int * * & p, int rows, int cols)`
8. `int** getMatrixCopy ( int * * & p, int row, int col )`
9. `bool isEqual(int * * & a, int row1, int col1 , int * * & b, int row2, int col2)`
10. `void freeMatrix (int * * & p , int row, int col);`
    Free the dynamically allocated memory.
11. `int** Transpose (int * * & p , int row, int col);`
12. `void reSize (int ** & p , int row, int col, int newrow, int newcol );`

13. bool isSymmetric (int * * & p , int row, int col)
    if At = A

14. bool isSkewSymmetric (int * * & p , int row, int col)
    if At =–A

15. int * * add (int * * & a, int row1, int col1 , int * * & b, int row2, int col2);

*IF we apply **Principle of least privilege***

***Use const wherever possible:** Then function prototypes should be as follows:*

```
1.  void createMatrix (int * * & m, const int row=1, const int Col=1);
2.  int& at(int * const * const & p, const int r, const int c);
3.  void printMatrix(const int * const * const & p, const int rows, const int cols)
4.  int isIdentity (const  int * * & p, const int rows, const int cols)
5.  bool isLowerTriangular (const int * const * const & p, const int rows, const int cols);
6.  bool isUpperTriangular (const int * const * const & p, const int rows, const int cols);
7.  bool isTriangular (const int * const * const & p, const int rows, const int cols);
8.  int** getMatrixCopy (const int * const * const & p, const int row, const int col );
9.  bool isEqual(const int * const * const & a, const int row1, const int col1 , const int * const * const & b, const int row2, const int col2);
10.  void freeMatrix (const int * const * const & p , const int row, const int col);
11. int** Transpose (const int * const * const & p , const int row, const int col);
12. void reSize (const int * const * const & p , const int row, const int col, const int newrow, const int newcol );
13. bool isSymmetric (const int * const * const & p , const int row, const int col);
14. bool isSkewSymmetric (const int * const * const & p , const int row, const int col);
15. int * * add (const int * const * const & a, const int row1, const int col1 , const int * const * const & b, const int row2, const int col2);
```