

User Guide :: matrix.h

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Necessary Header Files

```
#include <stdbool.h>
#include <stdlib.h>
#include <string.h>
```

Important Macros

#define OPERATION VALUE

```
#define ADDITION 0
#define SUBTRACTION 1
#define MULTIPLICATION 2
#define DETERMINANT 3
#define MINOR 4
#define COFACTOR 5
#define TRANSPOSE 6
#define ADJOINT 7
#define INVERSE 8
```

#define TYPE_OF_MATRIX VALUE

```
#define ROW_MATRIX 9
#define COLUMN_MATRIX 10
#define SQUARE_MATRIX 11
#define DIAGONAL_MATRIX 12
#define SCALAR_MATRIX 13
#define IDENTITY_MATRIX 14
#define UNIT_MATRIX 14
#define NULL_MATRIX 15
#define ZERO_MATRIX 15
#define UPPER_TRIANGULAR_MATRIX 16
#define LOWER_TRIANGULAR_MATRIX 17
```

```
#define TRIANGULAR_MATRIX 18
#define INVOLUTORY_MATRIX 19
#define IDEMPOTENT_MATRIX 20
#define SYMMETRIC_MATRIX 21
#define SKEW_SYMMETRIC_MATRIX 22
#define NILPOTENT_MATRIX 23
```

#define **TEXT_STYLE** **VALUE**

```
#define UPPER 24
#define LOWER 25
#define TITLE 26
```

Functions To Parse Numbers From String

It checks whether a **string** contains a **number** or not...

```
bool is_number(char *string)
```

It **splits** (by a character **c**) a **string** into **multiple strings** ...

```
char **split(char *string, char c)
```

It **parses** a **string** to retrieve **numbers** ...

```
double *parse_number(char *string, int num)
```

Matrix Structure

```
struct matrix
{
    int rows;
    int cols;
    double **data;
};

typedef struct matrix* Matrix;
```

Note : Keep In Your Mind That

All the **index** starts counting from **0** , not from **1** ...

Important Functions()

It checks whether a **Matrix** is **NULL** or not...

```
bool is_null(Matrix matrix)
```

It checks whether a **Matrix** is perfect for the **OPERATION** or not...

```
bool is_perfect(Matrix matrix, int OPERATION)
```

It checks whether the **Matrix(s)** are perfect for the **OPERATION** or not...

```
bool are_perfect(Matrix matrix_1, Matrix matrix_2, int OPERATION)
```

It checks whether the **Matrix(s)** are **identical** or not...

```
bool are_identical(Matrix matrix_1, Matrix matrix_2)
```

Create-Matrix Functions()

It creates a **< rows >** by **< cols >** **Matrix**

```
Matrix create_matrix(int rows, int cols)
```

It creates a **Empty Matrix**

```
Matrix empty()
```

It creates a `<n>` by `<n>` Identity or Unit Matrix

```
Matrix create_identity_matrix(int n)
```

Input Functions()

It takes `<rows>` by `<cols>` Matrix as a input

```
Matrix input_matrix(int rows, int cols)
```

It takes `<1>` by `<cols>` Row-Matrix as a input

```
Matrix input_row_matrix(int cols)
```

It takes `<rows>` by `<1>` Column-Matrix as a input

```
Matrix input_column_matrix(int rows)
```

It takes `<n>` by `<n>` Square-Matrix as a input

```
Matrix input_square_matrix(int n)
```

Modify Matrix

It Re-shapes the dimensions of the `<matrix>`

```
Matrix reshape(Matrix matrix, int rows, int cols)
```

It checks whether an Array `<*data>` can be converted into a `<row>` by `<cols>` Matrix or not

```
bool is_convertable(double *data, int rows, int cols)
```

It converts an Array `<*data>` into a `<rows>` by `<cols>` Matrix

```
Matrix make_matrix_from_array(double *data, int rows, int cols)
```

It Adds a new <row_matrix> after the last row of the <base_matrix>

```
Matrix append_row_matrix(Matrix base_matrix, Matrix row_matrix)
```

It Adds a new <column_matrix> after the last column of the <base_matrix>

```
Matrix append_column_matrix(Matrix base_matrix, Matrix column_matrix)
```

It Inserts a new <row_matrix> at the <index_of_row> -th position of the <base_matrix>

```
Matrix insert_row_matrix(Matrix base_matrix, int index_of_row, Matrix row_matrix)
```

It Inserts a new <column_matrix> at the <index_of_col> -th position of the <base_matrix>

```
Matrix insert_column_matrix(Matrix base_matrix, int index_of_col, Matrix column_matrix)
```

It Deletes <index_of_row> -th row from the <base_matrix>

```
Matrix del_row_matrix(Matrix base_matrix, int index_of_row)
```

It Deletes <index_of_col> -th column from the <base_matrix>

```
Matrix del_column_matrix(Matrix base_matrix, int index_of_col)
```

It Re-replaces <index_of_row> -th row of the <base_matrix> with <row_matrix>

```
Matrix replace_row_matrix(Matrix base_matrix, int index_of_row, Matrix row_matrix)
```

It Re-replaces <index_of_col> -th column of the <base_matrix> with <column_matrix>

```
Matrix replace_column_matrix(Matrix base_matrix, int index_of_col, Matrix column_matrix)
```

It Removes the last-row from the <base_matrix>

```
Matrix pop_row_matrix(Matrix base_matrix)
```

It Removes the last-column from the <base_matrix>

```
Matrix pop_column_matrix(Matrix base_matrix)
```

Get Matrix

It Returns <index_of_row>-th row of the <base_matrix>

```
Matrix get_row_matrix(Matrix base_matrix, int index_of_row)
```

It Returns <index_of_col>-th column of the <base_matrix>

```
Matrix get_column_matrix(Matrix base_matrix, int index_of_col)
```

It Prints the <matrix>

```
void print_matrix(Matrix matrix)
```

It Prints the list <char** types> which is made by the Function() named types()

```
void print_types(char **types)
```

Mathematical Functions()

It Returns the Principal-Diagonal of <matrix> in a Row-Matrix form

```
Matrix principal_diagonal(Matrix matrix)
```

It Returns the Principal-Diagonal of <matrix> in a Diagonal-Matrix form

```
Matrix principal_diagonal_matrix(Matrix matrix)
```

The Returns the Trace of <matrix>

```
double trace(Matrix matrix)
```

It Returns the Secondary-Diagonal of <matrix> in a Row-Matrix form

```
Matrix secondary_diagonal(Matrix matrix)
```

It Returns the Secondary-Diagonal of <matrix> in a Secondary-Diagonal-Matrix form

```
Matrix secondary_diagonal_matrix(Matrix matrix)
```

The Returns the Secondary-Trace Of <matrix>

```
double secondary_trace(Matrix matrix)
```

It Adds two Matrix (s) <matrix_1> and <matrix_2>

```
Matrix add(Matrix matrix_1, Matrix matrix_2)
```

It Adds a <row_matrix> with all the rows of the <base_matrix>

```
Matrix add_row_matrix(Matrix base_matrix, Matrix row_matrix)
```

It Adds a <column_matrix> with all the columns of the <base_matrix>

```
Matrix add_column_matrix(Matrix base_matrix, Matrix column_matrix)
```

It Subtracts two Matrix (s) <matrix_1> and <matrix_2>

```
Matrix subtract(Matrix matrix_1, Matrix matrix_2)
```

It Subtracts a <row_matrix> from all the rows of the <base_matrix>

```
Matrix subtract_row_matrix(Matrix base_matrix, Matrix row_matrix)
```

It Subtracts a <column_matrix> from all the columns of the <base_matrix>

```
Matrix subtract_column_matrix(Matrix base_matrix, Matrix column_matrix)
```

It Multiplies all of index (s) of the <matrix> by a <scalar_number>

```
Matrix multiply_by_scalar(Matrix matrix, double scalar_number)
```

It Multiplies two Matrix (s) <matrix_1> by <matrix_2>

```
Matrix multiply(Matrix matrix_1, Matrix matrix_2)
```

It Calculates the <matrix> to the power of <n>

```
Matrix power(Matrix matrix, int n)
```

It Returns the Minor-Matrix of the index (<index_row> , <index_col>)

```
Matrix minor_matrix(Matrix matrix, int index_row, int index_col)
```

It Calculates the Determinant of the <matrix>

```
double determinant(Matrix matrix)
```

It Calculates the Minor of <matrix> for the index (<index_row> , <index_col>)

```
double minor(Matrix matrix, int index_row, int index_col)
```

It Calculates the Co-Factor of <matrix> for the index (<index_row> , <index_col>)

```
double co_factor(Matrix matrix, int index_row, int index_col)
```

It Returns the Transpose-Matrix of the <matrix>


```
Matrix transpose(Matrix matrix)
```

It Returns the Adjoint-Matrix of the <matrix>

```
Matrix adjoint(Matrix matrix)
```

It Returns the Inverse-Matrix of the <matrix>

```
Matrix inverse(Matrix matrix)
```

It can Solve the Simultaneous-Linear-Equations by taking a Square-Matrix (It contains the Coefficients) and a Column-Matrix (It contains the Constants after the '=' sign)

```
Matrix solve(Matrix coefficients_square_matrix, Matrix constants_column_matrix)
```

It Checks the <TYPE> of a <matrix>

```
bool is_type_of(Matrix matrix, int TYPE)
```

It Lists all possible Types of a <matrix> and Returns a 2D-Char-Array where all the items will have the same <TEXT_STYLE>

```
char **types(Matrix matrix, int TEXT_STYLE)
```
