**HW5: Dynamic arrays as member variables.**

Create class Matrix, which has ***member variables:***

* int m, n //dimensions of the matrix
* dynamic 2D array of integers e,

***member functions:***

* Matrix()//default constructor creating a 3x3 matrix with elements =0,
* Matrix(int \_m, int \_n) //default constructor creating a matrix with dimensions m and n and elements =0,
* Matrix(int \_m, int \_n, int d) //constructorcreating a matrix of dimensions m and n, and having d-s on the main diagonal (when i==j), 0 –everywhere else
* **copy constructor,**
* **destructor,**

and **overloaded operators:** <<, >>, ==, **+, -** (binary and unary), **\*, = (assignment),**

defined as follows:

* << and >> (as in previous homework)
* A==B if for all i,j: A.e[i][j]==B.e[i][j]; //A and B are of the same dimensions m and n
* B=-A means that for all i,j: B.e[i][j]=-A.e[i][j];
* C=A+B means for all i,j: C.e[i][j]= A.e[i][j]+B.e[i][j]; //A and B are of the same dimensions mxn
* C=A-B means for all i,j: C.e[i][j]= A.e[i][j]-B.e[i][j]; //A and B are of the same dimensions mxn
* C=A\*B means for all i,j: C.e[i][j]= i-th row of A \* j-th column of B=sum of (A.e[i][k]\*B.e[k][j]) for k from 0 to n. //Here dimensions of A are mxn, dimensions of B are nxp, and dimensions of C are mxp
* A=B means assignment // A takes the same dimensions as B, all the elements of B copied to A

In the program test class Matrix, its functions, and operators:

* create Z3 – 3x3 matrix with all zeroes, output Z3 to the screen;
* create Z – 3x2 matrix with all zeroes, output Z to the screen;
* create A - 3x2 matrix with elements inputted from file, output A;
* create B as a copy of A; check that B== A;
* create C - 3x2 matrix (different from A) with elements inputted from file, output C;
* create E - diagonal 2x2 matrix with **1** on the main diagonal, 0 – everywhere else, output E;
* create D - diagonal 2x2 matrix with **2** on the main diagonal, 0 – everywhere else, output D;
* check (with ==) that
  + A==B is true, A==C is false,
  + A-B==Z is true,
  + –A==Z-A is true,
  + A+B == A\*D is true,
  + A\*E==A is true,
  + do the assignment: A=C; afterwards check that A==B is false, A==C is true.

**Submit input file, code, and output.**

**Extra credit (3 pts).**

Define a member function computing determinant of a **square** **nxn** matrix int det():

* if dimensions m and n are not equal, output an error message and return smallest negative integer
* if m=n=1, it is a matrix of one element and det=this element
* if m=n=2, det = (product of elements on the main diagonal - product of elements on the other diagonal)
* if m=n>2, A.det() = ∑j(-1)je[0][j]\*Matrix(A,j).det(),
  + where sum is taken for j=0,…,n-1,
  + Matrix(A,j) constructs the copy of A without the 1st row (corresponding to i=0) and jth column.

(check http://www.mathsisfun.com/algebra/matrix-determinant.html)

Test this member function on 7 square matrices:

* M =5 M.det() = 5
* N = 1 2 N.det() = -2

3 4

* E.det() = 1, D.det()=4
* P = 1 2 3 P.det() = 0

4 5 6

7 8 9

* Q=1 0 0 Q.det() = -3

1 2 3

4 5 6

* R=1 0 0 9 R.det() = -15

1 2 3 8

4 5 6 7

0 0 0 5