Programming 2 – Laboratory 6

Add missing code to the given class `matrix` in order to run main function's code.

Implement missing methods and operators. Class implement square matrix only. Maximum allowed dimension is: N=10. Consult attached *output.txt* file for expected program output.

Part 1 (2 points)

Implement method `void init(int n)` which check if given `int n` is in 0 < n <= 10 and set n class member field otherwise the class field should be set to 0.

Implement method `void fill(double d, double [][N])` which copy to class member array values given in second parameter or if only one parameter is given its value is used to initialize all array elements.

Implement class constructor `matrix( int n=0, double v=0 );` which takes as parameters size of matrix and value used to initialize all elements. Constructor must use init() and fill() methods.

Part 2 (1 point)

Implement operator() which takes two parameters (indices of row and column) and refer to matrix element value. Operators should return value of const object or allow to change elements value.

Part 3 (2 point)

Implement method `void random(int a, int b)` which set matrix elements with random integer values from given range a,b. Use following rand rand() to obtain number from range 0..32767

Implement static method: `matrix` eye(`int`), which return a matrix with diagonal values set to 1 and rest elements set to zeros.

Implement method transpose() which transpose elements of array.

Implement method norm() which calculate norm of matrix given by formula

$$\|A\| = \sqrt{\sum_i \sum_j a_{i,j}^2}$$

Part 4 (2 points)

Implement operators :

- + : sum of matrices
- - : subtract matrices
- * : multiply matrix by matrix

- * : multiply double by matrix
- == : compare two matrices, assume they are equal if corresponding values differences are not greater than eps (define `const double matrix::eps=1e-4;`)

Part 5 (1p)

Implement algorithm of pseudorandom calculation:

```
$Ak, Ak1, I \ \in R^{NxN}$
$I - is\ eye$
$alpha = \frac{1}{\|A\|^2}$
$Ak = alpha \cdot A^T$
$for\ i\ in\ 1, \ldots \mathrm{maxIter}$
    $Ak1 = Ak + Ak \cdot (I - A \cdot Ak)$
    $if\ \|Ak1 - Ak\| < eps, then\ break;$
    $Ak = Ak1$
$return\ Ak1$
```