Math 3300 - Homework 5

1. Over the next several parts, you will develop a **class** for a 2×2 matrix.

   (a) How many **private members** should you create? What statements would you need to do this?

   (b) Your class will contain 3 **constructors**:

   - If no parameters are provided, create: $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$
   - If one parameter a is provided, create: $\begin{pmatrix} a & 0 \\ 0 & a \end{pmatrix}$
   - If 4 parameters a, b, c, d are provided, create $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

   Create these **constructors**.

   (c) You will also create the following 6 **public member functions**: set (which will set all 4 parameters), get (which will get a specific entry in the matrix), transpose (which returns the transpose of the matrix), inverse (which returns the inverse of the matrix if it exists and returns the 0 matrix otherwise), trace (returns the trace of the matrix $a + d$), and determinant (returns the determinant of the matrix $ad - bc$). Create a complete **class definition** (approximately 13 lines) appropriate for these public member functions and the ones from the previous problems.

   (d) Create the **function definitions** for these public member functions.

   (e) **Overload the operators** $+, -, *$ for matrix operations. Overload $*$ for both scalar and matrix multiplication (i.e. $5A$ and AB).

   (f) **Overload the operator** $==$ for matrices. Two matrices of the same size are equal if all their corresponding entries are equal.

   (g) **Overload** $<<$ and $>>$ for your matrix class.

2. Now assume the class above has already been created.

   (a) How do you create a matrix named M?

   (b) How would you create the matrix $N = \begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$

   (c) A matrix A has been created. How would you get the entry in row 1 and column 2?

   (d) A matrix B has already been created, set it to be the matrix $\begin{pmatrix} -1 & 0 \\ 0 & 3 \end{pmatrix}$

   (e) A matrix C has been created. How would you display it's trace and determinant?

   (f) How would you display the inverse of a matrix D?