**CSCI 2150L**

**Session 8 Topics:**

**9/22/2014**

**Fall 2014**

1. At first we created a matrix by multiplying another two matrices B and A. Subsequently, we verified that the two operations E.\*E.\*E and E.^3 gives us the same result.
2. We created an array A to manipulate it for further experiments as follows.

A = [1 2 3; 2 4 12; 4 7 10]

1. For access to one specific row or column of a matrix we used a special character ‘:’ which denotes all the elements of a specified row or column. For e.g. if we wanted to access the second row of A above then the corresponding command would be A ( 2 , :) [Remember the first argument within parenthesis specifies row while the second argument is for column]. Similarly if we wanted to access the third column of A then we had to use A ( : , 3).
2. Linear systems of equations were introduced next. A System of linear equations with n variables needs at least n linear equations to find a solution for the variables. Such a system with three variables should have minimum of three equations listed as follows:

(1)

In (1) and () are constants. Moreover‘s are called coefficients. The system can also be represented using matrix as follows:

(2)

Try to convert the matrix representation above into (1) to convince yourself that both (1) and (2) are equivalent. A more generic representation of (2) for a linear system is where ***A*** is the coefficient matrix, ***x*** is the variable matrix.

Goal of the system of linear equations is to find solutions for all the n variables given the matrices ***A*** and ***b***. This can easily be achieved using MATLAB. The corresponding command to find the solutions for the variable ***x*** is ***A\b***.

1. Most of the time for a linear systems of equations the matrix *A* will be a square matrix. We discussed some aspects of a square matrix. They are as follows:
2. **Rank:** Rank of a matrix determines the maximum number of linearly independent rows or columns in a matrix. If one row (or column) can be converted into another row (or column) of a matrix by means of some linear operations (like multiplying one row by a constant, element wise subtracting or adding one row to another, etc.) then the corresponding pair of rows (or columns) are not independent to each other. For e.g. if the second row of the matrix *A* in 2 was [2 4 6] instead of [2 4 12] then multiplying the first row by 2 would give us the second row. Under this scenario the first and second row of *A* were not independent. Subsequently the rank of *A* would be 2 suggesting at most two rows or columns of *A* could be independent. [Notice that the rank of a matrix should be at least n to solve a system of linear equation involving n variables]. Using MATLAB we can find the rank of matrix by command **rank(A)** where the argument of the command is the name of the matrix.
3. **Inverse of a matrix:** Inverse of a matrix *A* is denoted as *A*-1 such that the following operation would always give us identity matrix.

Where *I* is an identity matrix with the same dimension as *A*. In an identity matrix all elements except the diagonal ones are 0; All the diagonal elements are 1’s. An identity matrix of dimension is shown below:

To find inverse of a matrix we used **inv(A)** command in MATLAB whose argument is the name of the matrix.

1. **Determinant:** Determinant of a square matrix is a scalar factor associated with matrix. We didn’t discuss this in detail. See the next handout to find the detail experiment we will do with this.