**CSCI 2150L**

**Session 9 Topics:**

**9/24/2014**

**Fall 2014**

1. The first topic was regarding determinant of a matrix. We discussed how to find determinants of the square matrices as follows.

[Note the pattern for evaluating these matrices; each element from the first row of the matrix are picked in turn. The elements of the matrix that remains after ignoring the row and columns of the picked element forms another square matrix. The determinant of this matrix is multiplied with the picked element. For e.g. while picking element *b* from matrix *C* we ignore first row and second column and as a result the remaining element formed a matrix whose determinant is associated with *b*. Also notice the alternating pattern of + and – sign in the expression.]

Following the same pattern the determinant of a matrix will be determined as follows:

1. Next we discussed the significance of a determinant. If a matrix *A* with determinant d is applied to a set of points then the transformed points would cover a larger area than the initial points which would be approximately *d* times the previous area.

To demonstrate this we chose an ellipse on which the transformation will be applied. The steps listed below were followed.

1. One row vector was created.
2. We found the points corresponding to the ellipse by using parametric equation of an ellipse as follows:
3. The *x* and *y* points were brought together to form another matrix *B* = [*x* ; *y*].
4. We chose another matrix with .
5. Subsequently the initial *x* and *y* points were transformed and stored into another matrix *C* as follows .
6. To visualize the initial and transformed points we plotted them together using command **plot(B(1,:), B(2,:), C(1,:), C(2,:))**. Note the use of character ‘:’ to extract the *x* and *y* values of initial and transformed ellipse. We noted the transformed set of points describe a larger area which is approximately 6 times the area of the original ellipse.
7. Some special matrices were introduced.
8. Symmetric matrix: A square matrix with dimension will be called symmetric if it has the same matrix as its transpose i.e. for a symmetric matrix *A*; .

For any symmetric matrix with where ‘s are the matrix element.

For e.g. the following matrix is a symmetric matrix

Check whether the condition of a symmetric matrix is met for the matrix above.

1. Skew-Symmetric matrix: Similar to above a square matrix with dimension will be called skew-symmetric if it has the same matrix as the negative of its transpose i.e. for a skew-symmetric matrix *A*; .

For any skew-symmetric matrix with where ‘s are the matrix element.

For e.g. the following matrix is a skew-symmetric matrix

1. We briefly discussed the notion of orthogonality. Two row vectors (or two column vectors) R1 and R2 will be called orthogonal to each other is their dot product is 0. [Remember dot product between two vectors is found by multiplying their corresponding elements and adding the results together.] For e.g. if R1 = [2 2 -4] and R2 = [3 1 2] then R1.R2 = 2\*3 + 2\*1 + (-4)\*2 = 0. So, R1 and R2 will be orthogonal to each other.
2. Orthogonal Matrix: A square matrix with dimension is orthogonal if all the rows and columns are orthogonal to each other. Following is an orthogonal matrix of dimension .

We’ll talk about the scaling factor (1/9) of the matrix in class.