**CST325 HW 3.2 – Matrix Details**

**(xx question points weighted to 75 grade points)**

1. (True / False) Determine the validity of each equation for the matrices A and B. (5 pts)
   1. TRUE
   2. FALSE
   3. TRUE
   4. FALSE
   5. TRUE
2. Express the following matrix multiplication as a linear combination of basis vectors (as opposed to the algorithmic row-column dot product method). (10 pts)

1. If we wanted to multiply a **column** vector with a square matrix such that the vector was on the left and the matrix was on the right, could we do it? If so, how? If not, what would we have to do to in order to be able to multiply them? (15 pts)

You are not able to multiply a column vector with a square matrix when the column vector is on the left and matrix is on the right. In order to be able to multiply them, you must transpose the column vector and the matrix before multiplying them together.

1. (True / False) The term orthogonal has the same meaning for both vectors and matrices. (3pts)
2. (True / False) An orthogonal matrix’s rows and columns are both mutually orthogonal to each other **and** unit length. (3pts) TRUE
3. Is the matrix below orthogonal? Show why or why not. (6pts)
4. (True / False) (1pt) TRUE
5. (True / False) (1pts)
6. (True / False) Matrix multiplication does not commute for **any** pair of matrices . (2pts) FALSE
7. Derive a 2x2 rotation matrix. Your answer should include a labeled graph and an English description of what it is and how you are depicting it. (10pts)
8. When is a matrix transpose also equal to its inverse? (3pts) When the matrix is orthogonal.
9. (True / False) A rotation matrix only rotates about the current origin (the zero vector). **Justify your answer**. (3pts)
10. (True / False) A scale matrix will displace any vector it is applied to by the same amount. In other words, the distance between the vector’s original location and its new scaled location will be the same amount for every vector. **Justify your answer**. (2pts)
11. What is the geometric interpretation of the determinant in both 2 & 3 dimensions? (3pts)
12. With respect to transformations, name one way that a matrix inverse useful. (2pts)
13. Given a vector and a matrix , create an expression that is equal to product , only the vector is multiplied from the left. (6pts)
14. What is “gimbal lock” and how does it happen? (3pts)

Gimbal lock is when the of one degree of freedom in a plane of rotation. This is caused by representing an orientation as three axial rotations with Euler angles. This will make one of the basis vectors in a plane of rotation rotate in a way such that is aligns with axis of rotation.

1. What are homogeneous coordinates? (2pts)
2. How do homogenous coordinates facilitate translation in a matrix? (5pts)