EE 570: Homework 1

1. Is GPS a dead reckoning or position fixing navigation technology? Explain.

2. Is odometry (speed) a dead reckoning or position fixing navigation technology? Explain.

3. Derive C_1^2 and show that $C_1^2 = (C_2^1)^T$.

4. For each of the matrices below, determine which ones are a valid transformation matrix. Explain

   (a)
   $$\begin{pmatrix} 0.8214 & -0.2212 & 0.5257 \\ 0.3830 & 0.8969 & -0.2212 \\ -0.4226 & 0.3830 & 0.8214 \end{pmatrix}$$
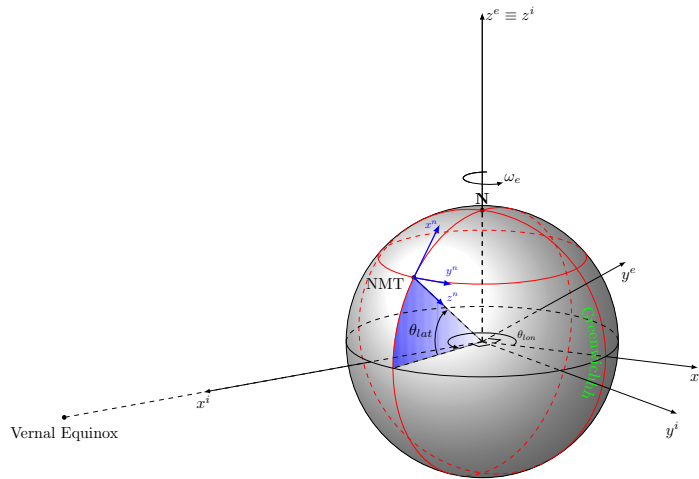
   (b)
   $$\begin{pmatrix} 0.9998 & -0.008727 & 0.01745 \\ 0.008725 & 1.000 & 0.0001523 \\ -0.01745 & 0.0000 & 0.9998 \end{pmatrix}$$

   (c)
   $$\begin{pmatrix} 0.8725 & 1.000 & 0.0001523 \\ 0.9998 & -0.8727 & 0.1745 \\ -0.1745 & 0.7000 & 0.9998 \end{pmatrix}$$

5. What is the nav frame resolved in the ECEF frame (i.e. C_n^e)

6. Given the following transformation obtained using relative transformation of $R_{(z,\psi)}R_{(y,\theta)}R_{(x,\phi)}$

   $$\begin{pmatrix} 0.9998 & -0.008625 & 0.01750 \\ 0.008725 & 0.9999 & -0.005665 \\ -0.01745 & 0.005817 & 0.9998 \end{pmatrix}$$

   (a) compute the angles ψ, θ, and ϕ.

   (b) compute the angles if you were to achieve the same orientation but using fixed angle rotation

   (c) compute the equivalent angle-axis rotation, i.e., $\vec{k}$ and θ