Question Set 4

CS 420

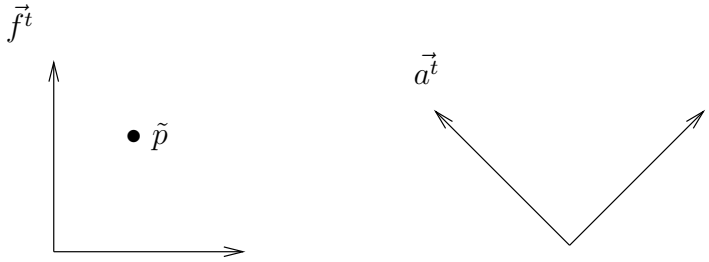
Chapter 4

1. Let

$$S = \begin{bmatrix} 0.5 & 0 & 0 & 0 \\ 0 & 0.5 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

   What transformation is accomplished by this matrix?

2. Consider S from the previous problem.



   Note: For $\vec{\mathbf{f}}^t$, $\tilde{p}$ is in quadrant 1; for $\vec{\mathbf{a}}^t$, $\tilde{p}$ is in quadrant 2.

   (a) Describe $\tilde{p} = \vec{\mathbf{f}}^t\mathbf{c} \Rightarrow \vec{\mathbf{f}}^t S\mathbf{c}$ and draw the transformed point.

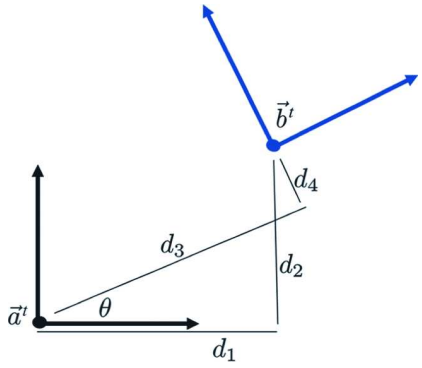
   (b) Describe $\tilde{p} = \vec{\mathbf{a}}^t\mathbf{c} \Rightarrow \vec{\mathbf{a}}^t S\mathbf{c}$ and draw the transformed point.

3. Let $\tilde{q} = \vec{\mathbf{f}}^t\mathbf{c}$ and $\vec{\mathbf{a}}^t = \vec{\mathbf{f}}^t A$. What are $\tilde{q}$'s coordinates with respect to $\vec{\mathbf{a}}^t$?

4. State the "left of" rule and illustrate it with an example.

5. Using the definitions of Section 4.2, draw two different sketches illustrating the transformation $\vec{\mathbf{f}}^t \Rightarrow \vec{\mathbf{f}}^t RT$.

6. Consider the following two orthonormal frames $\vec{\mathbf{a}}^t$ and $\vec{\mathbf{b}}^t$ with the positive z axis coming out of the figure towards you.



Distances are given by the positive quantities d_i.

(a) What are the matrices R and T such that $\vec{\mathbf{b}}^t = \vec{\mathbf{a}}^t TR$?

(b) What are the matrices R and T such that $\vec{\mathbf{b}}^t = \vec{\mathbf{a}}^t RT$?

Your transformation matrices should be 4×4 and only matrix R should contain trigonometric terms. Refer to the bottom of pg. 17 and top of pg. 18 of the textbook when constructing R.