MATH 114 - Fall 2016 - Assignment 4

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Problem 1. Matrix-Vector Products

a) 2x2 $\cdot$ 2x1 = 2x1

$$\begin{bmatrix} 2 & -4 \\ 5 & -3 \end{bmatrix} \begin{bmatrix} 4 \\ -2 \end{bmatrix} = \begin{bmatrix} (2 \cdot 4) + (-4 \cdot -2) \\ (5 \cdot 4) + (-3 \cdot -2) \end{bmatrix} = \begin{bmatrix} 16 \\ 26 \end{bmatrix}$$

b) 2x3 $\cdot$ 3x1 = 2x1

$$\begin{bmatrix} 1 & 2 & 3 \\ -3 & -2 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix} = \begin{bmatrix} 4 \\ -8 \end{bmatrix}$$

Problem 2. Matrix-Matrix Products

a) 2x2 $\cdot$ 2x3 = 2x3

$$\begin{bmatrix} 2 & 2 \\ 3 & 3 \end{bmatrix} \begin{bmatrix} -3 & 4 & 2 \\ 1 & -4 & -6 \end{bmatrix} = \begin{bmatrix} -6+2 & 8+-8 & 4+-12 \\ -9+3 & 12-12 & 6-18 \end{bmatrix} = \begin{bmatrix} -4 & 0 & -8 \\ -6 & 0 & -12 \end{bmatrix}$$

b) 3x2 $\cdot$ 2x2 = 3x2

$$\begin{bmatrix} 1 & 1 \\ 2 & 2 \\ 3 & 3 \end{bmatrix} \begin{bmatrix} 3 & -1 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 3+4 & -1+5 \\ 6+8 & -2+10 \\ 9+12 & -3+15 \end{bmatrix} = \begin{bmatrix} 7 & 4 \\ 14 & 8 \\ 21 & 12 \end{bmatrix}$$

Problem 3. Matrix Multiplications

a)

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 1+4+9 \end{bmatrix} = \begin{bmatrix} 14 \end{bmatrix}$$

b)

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$$

Problem 4. Geometric Transformations

By rotating the result by $\frac{-\pi}{4}$ we will reverse the rotation made to get $(-1, \sqrt{2}, 0)$.
3x3 $\cdot$ 3x1 = 3x1

$$\begin{bmatrix} \cos\frac{-\pi}{4} & \sin\frac{-\pi}{4} \\ -\sin\frac{-\pi}{4} & \cos\frac{-\pi}{4} \end{bmatrix} \begin{bmatrix} -1 \\ \sqrt{2} \end{bmatrix} = \begin{bmatrix} \frac{-\sqrt{2}-2}{2} \\ \frac{-\sqrt{2}+2}{2} \end{bmatrix}$$

Problem 5. Geometric Transformations

For all questions below, I assumed that the matrix A was to be multiplied with the input vector $\vec{v}$. Thus A is the matrix that will change $\vec{v}$ to get the desired transformation.
a)

$$\begin{bmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{bmatrix}$$

b) - This is a simplification of having π as θ in the rotation vector.

$$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

c) -

d)

Problem 6. Geometric Transformations

Problem 7. Geometric Transformations

a)