CPSC 314, Worksheet 1 Name: Solutions Student number: _____

due: Mon Sept 10, in class

1. Math review

$$a = \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix}, b = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}, C = \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 3 \\ 1 & 2 & 2 \end{bmatrix}, d = 2$$

For each of the following, compute the answer or, if it cannot be evaluated, state that it is a "nonsense" expression.

$b^T a$ $= \begin{bmatrix} 2 & -1 & 4 \end{bmatrix} \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix} = 2+3+8 = 13$ "inner product"

$b\,a$ nonsense expression

$a\,b^T$ $\begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix} \begin{bmatrix} 2 & -1 & 4 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 4 \\ -6 & 3 & -12 \\ 4 & -2 & 8 \end{bmatrix}$ "outer product"

$a^T b$ $= (b^T a)^T = 13$ as above

$a\,d$ $= \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix} \cdot 2 = \begin{bmatrix} 2 \\ -6 \\ 4 \end{bmatrix}$

$d\,C$ $= 2 \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 3 \\ 1 & 2 & 2 \end{bmatrix} = \begin{bmatrix} -2 & 2 & 0 \\ 2 & 0 & 6 \\ 2 & 4 & 4 \end{bmatrix}$

$b\,C$ nonsense expression

$C\,a$ $= \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 3 \\ 1 & 2 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix} = \begin{bmatrix} -1-3+0 \\ 1+0+6 \\ 1-6+4 \end{bmatrix} = \begin{bmatrix} -4 \\ 7 \\ -1 \end{bmatrix}$

$b^T C\,a$ $= \begin{bmatrix} 2 & -1 & 4 \end{bmatrix} \begin{bmatrix} -4 \\ 7 \\ -1 \end{bmatrix} = -8-7-4 = -19$

a^2 nonsense expression

$C\,C^T$ $= \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 3 \\ 1 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 1 & 1 \\ 1 & 0 & 2 \\ 0 & 3 & 2 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 10 & 7 \\ 1 & 7 & 9 \end{bmatrix}$

$a \cdot b$ $= a^T b = 13$

dimension mismatch

$\begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix} \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 3 \\ 1 & 2 & 2 \end{bmatrix}$