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Quiz 3

This quiz is graded out of 10 marks. No books, calculators, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. §1.2 #5i *(3 marks)* Consider the matrices

$$A=\begin{bmatrix}3&0\\-1&2\\1&1\end{bmatrix},\ B=\begin{bmatrix}4&-1\\0&2\end{bmatrix},\ C=\begin{bmatrix}1&4&2\\3&1&5\end{bmatrix},\ D=\begin{bmatrix}1&5&2\\-1&0&1\\3&2&4\end{bmatrix},\ E=\begin{bmatrix}6&1&3\\-1&1&2\\4&1&3\end{bmatrix}$$

Compute the given expression (if possible): $\operatorname{tr}(DD^T)$.

$$\operatorname{tr}(DD^T)=\operatorname{tr}\left(\begin{bmatrix}1&5&2\\-1&0&1\\3&2&4\end{bmatrix}\begin{bmatrix}1&-1&3\\5&0&2\\2&1&4\end{bmatrix}\right)=\operatorname{tr}\left(\begin{bmatrix}30&1&21\\1&2&1\\21&1&29\end{bmatrix}\right)$$

$$=30+2+29=61$$

Question 2. §1.3 #20b *(2 marks)* Show that if A is an $m\times n$ matrix and $A(BA)$ is defined, then B is an $n\times m$ matrix.

In order for the product BA to be defined B needs the same amount of columns as A has rows. So m columns

In order for the product $A(BA)$ to be defined BA needs the same amount of rows as A has columns. So BA needs to have n rows. So B needs to have n rows.

Similarly

$$\underset{m\times n}{A}(\underset{n\times m}{B}\,\underset{m\times n}{A})$$

Question 3. §1.4 #16 *(3 marks)* Use the given information to find A.

$$(5A^T)^{-1}=\begin{bmatrix}-3&-1\\5&2\end{bmatrix}$$

$$\left[(5A^T)^{-1}\right]^{-1}=\begin{bmatrix}-3&-1\\5&2\end{bmatrix}^{-1}$$

$$5A^T=\frac{1}{(-3)(2)-(-1)(5)}\begin{bmatrix}2&1\\-5&-3\end{bmatrix}$$

$$5A^T=-1\begin{bmatrix}2&1\\-5&-3\end{bmatrix}$$

$$A^T=\begin{bmatrix}-2/5&-1/5\\1&3/5\end{bmatrix}$$

$$A=\begin{bmatrix}-2/5&1\\-1/5&3/5\end{bmatrix}$$

Question 4. §1.4 #TF *(2 marks)* Determine whether the statement is true or false, and justify your answer.
Two $n\times n$ matrices, A and B, are inverses of one another if and only if $AB=BA=0$.

False A and B are inverses of each other iff $AB=BA=I$.