Quiz List for Math 304-04, Fall 2018

Quiz 1. (M 8/27)

Qn 1. What is my name?

Qn 2. Let $a, b \in \mathbb{R}$. What is the rank of the matrix $M = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$?

Quiz 2. (F 8/31)

Qn 1. What is your name?

Qn 2. Assume C is a 4×6 matrix with rank 4. Let L_C be the function whose equation is $L_C(\mathbf{x}) = C \cdot \mathbf{x}$.

(i) What is the domain of L_C?
(ii) What is the codomain of L_C?
(iii) Is L_C one-to-one (injective)? Why?
(iv) Is L_C onto (surjective)? Why?

Quiz 3. (M 9/17)

Qn 1. Write $\mathbf{x} = \begin{bmatrix} 1 \\ 3 \\ 9 \\ 4 \end{bmatrix}$ as a linear combination of the standard basis vectors in $\mathbb{R}^4$.

Qn 2. A linear transformation $L : \mathbb{R}^2 \to \mathbb{R}^3$ has values

$$L(\mathbf{e}_1) = \begin{bmatrix} 2 \\ 2 \\ 0 \end{bmatrix} \text{ and } L(\mathbf{e}_2) = \begin{bmatrix} 3 \\ 0 \\ -1 \end{bmatrix}.$$

What is the matrix of L?

Quiz 4. (W 10/3)

Qn 1. Suppose A and B are symmetric $n \times n$ matrices. Prove that AB is symmetric if and only if $AB = BA$.

Quiz 5. (F 10/5)

Qn 1. Write the definition of when a matrix A is symmetric.

Qn 2. Write the vector $\begin{bmatrix} 1 \\ -1 \\ \pi \\ e \end{bmatrix}$ as a linear combination of the standard basis vectors in $\mathbb{R}^4$.

Qn 3. Write $\begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}$ as a linear combination of $\begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$, $\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$, if possible. If not, show it is impossible.

Quiz 6. (M 10/29)

Two bases of $\mathbb{R}^3$ are $\mathcal{E} = \{\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3\}$ and

$$\mathcal{B} = \left\{ \mathbf{b}_1 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \ \mathbf{b}_2 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, \ \mathbf{b}_3 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \right\}.$$

(a) Find the coordinate vector of $\mathbf{v} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ with respect to $\mathcal{B}$.

(b) If $[\mathbf{w}]_{\mathcal{B}} = \begin{bmatrix} 5 \\ 0 \\ -1 \end{bmatrix}$, what is $\mathbf{w}$?

(c) Find the transition matrix (change of basis matrix) ${}_{\mathcal{E}}P_{\mathcal{B}}$.

(d) How is ${}_{\mathcal{E}}P_{\mathcal{B}}$ related to ${}_{\mathcal{E}}\mathcal{B}P_{\mathcal{E}}$? (Do not compute.)

Quiz 7. (F 11/9)

Let $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ -1 & 0 & 1 \end{bmatrix}$.

Qn 1. Find all eigenvalues of A and their eigenspaces.

Qn 2. Compare their algebraic and geometric multiplicities.

Quiz 8. (M 11/19)

Diagonalize $\begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$. That means

1. Find the eigenvalues.
2. Find the eigenvectors.
3. Find the matrices P and D such that $A = PDP^{-1}$.