HACETTEPE UNIVERSITY

MAT 254 - Final - June 23, 2020

Department of Computer Engineering

Student Name and Number:____

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Question#	1	2	3	4	Total
Question Value	25	25	25	25	100
Your Grade					

1. Let $V = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a + c = b + d \right\}$ and $T : V \to \mathbb{R}$ with $T\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix} \right) = a + c$.

   a) Find a basis for the kernel of T. $\dim(\mathrm{Ker}(T)) = ?$ (10P)

   b) Find a basis for the image of T. $\dim(\mathrm{Im}(T)) = ?$ (10P)

   c) Is T an isomorphism? (5P)

2. Let $T = \{(2,3), (3,2)\}$ be a basis for $\mathbb{R}^2$ and $S = \{(1,0,0), (0,1,0), (0,0,1)\}$ be the standard basis for $\mathbb{R}^3$. Determine the linear transformation $L : \mathbb{R}^3 \to \mathbb{R}^2$ such that the matrix ${}_T[L]_S$ of L relative to the bases S and T is $A = \begin{bmatrix} -1 & 0 & -1 \\ 0 & 1 & 1 \end{bmatrix}$.

3. Consider the basis $S = \{(1,0,-1), (-1,1,0), (0,1,1)\}$ of $\mathbb{R}^3$. Apply Gram-Schmidt orthogonalization process to S and find an orthonormal basis for $\mathbb{R}^3$.

4. Find the eigenvalues and the eigenvectors corresponding to the eigenvalues of the matrix

$$A = \begin{bmatrix} -4 & 0 & 3 \\ 0 & -1 & 0 \\ -6 & 0 & 5 \end{bmatrix}$$

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GOOD LUCK