

# Homework 1

## MATH 120

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1. Find the transformation matrix  $T$  from the basis  $B = \{(1, 0, 0)^T, (1, 1, 0)^T, (1, 1, 1)^T\}$  to the standard basis.

2. Give the matrix representing the linear transformation

$$L(x, y, z) = (2x - 3y, x + 4z, 2y - 5z)$$

with respect to the standard basis.

3. Give the matrix representing the linear transformation

$$L(x, y, z) = (2x - 3y, x + 4z, 2y - 5z)$$

with respect to the basis  $(1, 0, 0)^T, (1, 1, 0)^T, (1, 1, 1)^T$ .

4. Find the eigenvalues and their associated eigenvectors of the matrix  $\begin{pmatrix} 1 & 2 & -1 \\ 1 & 0 & 1 \\ 4 & -4 & 5 \end{pmatrix}$ .

5. Find an orthogonal matrix which diagonalizes  $\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$ .

6. Find the orthogonal complement of the subspace  $W = \text{span}\{(1, 2, 0, 1)^T, (1, 0, 3, 2)^T\}$ .

7. Find a symmetric matrix which represents the quadratic form

$$f(x, y, z) = x^2 + 4xy - xz + 6yz - 3z^2.$$

8. Determine if the matrix  $\begin{pmatrix} 1 & 2 & -1 \\ 2 & 5 & 3 \\ -1 & 3 & 5 \end{pmatrix}$  is positive definite, negative definite or neither.

9. Problem 3.5 on page 35.

10. Problem 3.13 on page 36.