

Mock midterm # 1.

1. Consider the following three properties:

1. $T = T^{-1}$ (involution)
2. $T = T^*$ (Hermitian matrix)
3. $T^* = T^{-1}$ (unitary matrix)

What can you say about the eigenvalues of each of these types of matrices? Prove that any two of these properties imply the third.

2. Suppose you made the following assignments in MATLAB:

```
u=[1 2 3]';  
v=[4 5 6]';
```

What output should you get for each of the following operations?

```
u'*v  
u.*v  
u*v'  
v(2:3) * u(1,2)'
```

3. Consider the matrix

$$A = \begin{bmatrix} 0.1 & 1 \\ 0 & -100 \end{bmatrix}.$$

Determine its

1. dominant eigenpair,
 2. spectral radius,
 3. 1-norm,
 4. condition number for the 1-norm.
4. Use Householder's method to reduce the matrix

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

to tridiagonal form. (To be performed by hand.)