

# Homework 7

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## Part I: Written Exercises

1.

Answer:

For each  $v$ , we can calculate the result of  $v^T Dv$ .

$$v_1^T Dv_1 = 157$$

$$v_2^T Dv_2 = 84.1437$$

$$v_3^T Dv_3 = 44.25$$

So  $v = [1 \ 0 \ 0 \ 0]^T$  will maximize  $v^T Dv$ . There is no better unit vector  $v$ .

2.

Answer:

$$V^T v_1 = \begin{bmatrix} 0.999 \\ -0.000595 \\ -0.000563 \\ 0.000120 \end{bmatrix}$$

$$V^T v_2 = \begin{bmatrix} -0.000595 \\ 1.000 \\ 0.000195 \\ 0.000280 \end{bmatrix}$$

$$V^T v_3 = \begin{bmatrix} -0.000563 \\ 0.000195 \\ 1.001 \\ -0.000120 \end{bmatrix}$$

$$V^T v_4 = \begin{bmatrix} 0.000120 \\ 0.000280 \\ -0.000120 \\ 1.00160 \end{bmatrix}$$

3.

Answer:

Based on the Question-1 result, if we want to maximize the of  $v^T Av$ , we need to let the first element

of  $v$  maximize. So  $v = \begin{bmatrix} -0.477 \\ 0.476 \\ 0.561 \\ -0.480 \end{bmatrix}$  can maximize  $v^T Av$ .

4.

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*Answer:*

Multiple constants only scale results without changing results relationship. So still  $v = \begin{bmatrix} -0.477 \\ 0.476 \\ 0.561 \\ -0.480 \end{bmatrix}$  can maximize  $v^T Av$ .