

Name: _____ Roll Number: _____

- (5 points) For a symmetric, positive-definite matrix \mathbf{A} , show that the non-trivial maximizer of $\mathbf{x}^T \mathbf{A} \mathbf{x}$ is the eigenvector of \mathbf{A} corresponding to the largest eigenvalue.
- (1 point) Find the convolution mask that is convolved with the left image to give the results on the right?

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	0	0	0
0	0	0	1	1	1	1	0	0	0
0	0	0	1	1	1	1	0	0	0
0	0	0	1	1	1	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

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0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	-1	-1	0	0	1	1	0
0	-1	-1	0	0	1	1	0
0	-1	-1	0	0	1	1	0
0	-1	-1	0	0	1	1	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

- (2 points) Write the separable versions of the following filters.

a)

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

b)

$$\frac{1}{8} \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

- Let \mathbf{I} be a $p \times q$ image and \mathbf{M} an $m \times m$ convolution mask.

- (1 point) What is the cost of convolution?
- (1 point) What is the cost of convolution if \mathbf{M} is separable?