**EECS 442 F17 Quiz 4 10/5** Jason J. Corso, jjcorso@umich.edu

Name:

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**Directions** – *The quiz is closed book/notes. You have 15 minutes to complete it; use this paper only.*

**Problem 1: Recall (2 pts, 0.5 for each) (Write down only T or F)**

Harris operator is invariant to ...

(a) Translation ( ) (b) Rotation ( )
(c) Scale ( ) (d) Intensity shift ( )

*Solution:*
T, T, F, T

**Problem 2: Recall (2 pts, 1 for each) (Write down a proper term for each blank)**

(a) SIFT descriptor is more robust to pose and intra-class variation than a simple patch or bank of filters thanks to _____. (Hint: It is an estimation of probability distribution)

(b) Scale of traditional SIFT is decided by _____ response.

*Solution:*
histogram, DoG

**Problem 3: Comprehension (6 pts, 1 for each) (Find the proper kernel and fill in the blanks)**

(F1)

(F2)

(F3)

(F4)

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 12 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \quad \begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix} \quad \frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 1 & 1 \end{bmatrix} \quad \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

(K1) (K2) (K3) (K4) (K5)

F1 is the Gaussian-filtered image of ”cameraman”. Here ...

(a) F2 is the image after applying convolution to F1 with K___. Edges along x-axis are the _____ of F2.

(b) F3 is the image after applying convolution to F1 with K___. Edges along y-axis are the _____ of F3.

(c) F4 is the image after applying convolution to F1 with K___. Blobs are the _____ of F4.

*Solution:*

5, 2, 3. All the following answers are accepted: extrema, maxima, ...