

For each question, there is one correct answer

- 1) Which of the following properties do all receptive fields of LGN neurons have:
  - a. They have a center-surround organization
  - b. They are orientation selective
  - c. They are binocular
  - d. They have overlapping ON and OFF regions
  - e. They are color-opponent
- 2) Which of the following statements about anatomical circuitry is correct:
  - a. Horizontal cells have synapses only with cones
  - b. Amacrine cells have very long axons
  - c. Bipolar cells carry information from the photoreceptors to the ganglion cells
  - d. Rods and cones are homogeneously distributed in the retina
  - e. Photoreceptors inner segments are attached to the back of the eye.
- 3) Which formula best defines the contrast  $C$  of a surface within an image:
  - a.  $C = \text{reflectance} \times \text{illuminance}$
  - b.  $C = \text{mean luminance} - \text{surface luminance}$
  - c.  $C = \text{mean luminance} + \text{surface luminance}$
  - d.  $C = (\text{surface luminance} - \text{mean luminance}) / \text{mean luminance}$
  - e.  $C = (\text{surface reflectance} - \text{mean luminance}) / \text{mean reflectance}$
- 4) If you turn a small spot of light on the center of an OFF ganglion with a non-zero baseline firing rate at time  $T_0$  and turn it off at time  $T_1$ , which response is most likely to happen
  - a. At time  $T_0$ , the firing rate doesn't change, and goes quickly below baseline at time  $T_1$ .
  - b. At time  $T_0$ , the firing rate increases abruptly, slowly decays until  $T_1$ , then goes back quickly to baseline.
  - c. At time  $T_0$  the firing rate goes quickly below baseline, increases slowly until  $T_1$ , then becomes abruptly much higher than baseline, and eventually returns to baseline.
  - d. At time  $T_0$  the firing rate goes quickly below baseline, increases slowly until  $T_1$ , then returns slowly to baseline
  - e. At time  $T_0$  the firing rate increases quickly, slowly decays until  $T_1$ , then drops below baseline and eventually returns to baseline.
- 5) If you filter an image with a DoG filter (and ignore what happens at the edges), what is the most likely outcome
  - a. The resulting image will have more high frequency components than the original image
  - b. The resulting image will be blurred
  - c. The resulting image will have a uniform luminance
  - d. Vertical and horizontal orientations will fade
  - e. Only the oblique orientations will fade.
- 6) Fourier (or linear system) theory claims that
  - a. Any two dimensional Image can be decomposed into a sum of vertical and horizontal sinewaves
  - b. A square wave can be built by adding a fundamental frequency and its even harmonics
  - c. The output of a linear system to a square wave input is a single sinewave at the input's fundamental frequency
  - d. The output of a linear system to an input sinewave will be a sinewave with the input's frequency

- e. The phase of an input is unchanged by a linear filter.
- 7) Which statement describes the human contrast sensitivity function (CSF) best
- a. The CSF peaks around 4-5 c/deg, decreases slowly for higher frequencies, and much more abruptly for lower frequencies
  - b. The CFS has a perfect low-pass profile
  - c. The CSF peaks around 4-5 c/deg, decreases abruptly above the peak, and decays slowly for lower frequencies
  - d. The CSF is perfectly symmetrical around the peak frequency
  - e. The CSF plots the contrast threshold of a human observer on the y-axis and the spatial frequency of the stimulus on the x-axis.