The final exam is optional. If you are satisfied with your estimated grade at the end of the regular classes, then you do not need to take the exam. Your estimated grade will then become your final class grade. If you do choose to take the final exam, it will not hurt you. Even if you do badly on the final exam, your grade will be no lower than the grade you would get if you did not take the final exam.

The exam will include 75 multiple choice questions worth 2 points each. This exam makes up 20% of your class grade.

You are responsible for knowing both the material in the textbook and in lecture. The exam will draw from both sources.

You do not need a calculator for this exam.

At the end of each chapter in the textbook there are study questions. I will use these for creation of multiple choice questions. The questions will be drawn from the following:

• For all chapters, you do not need to worry about any of the questions related to the “Across the senses and plasticity” or “Brain scan” parts of the text. You are only responsible for the questions related to the main text.

• For the remaining study guide questions, you are responsible for all of the even numbered questions (2, 4, 6,...).

Of course, you may have to know the material from other study questions in order to answer these particular questions, but this is a way to focus your studying efforts.

In addition, multiple choice questions will be drawn from the material below. This material was discussed in the lectures, but much of it is also discussed in the textbook. Although originally phrased as a short answer question, each of these topics can be converted in to a multiple choice question.

Lecture 2

1. What is psychophysics? How is it different from philosophical studies of perception?

2. How does the method of limits work to measure perception?

3. When might you want to measure a threshold, percentage correct, or reaction time?

Lecture 3

1. What is the relationship between the wavelength of light and perceived color?

2. What do the terms illuminant, luminance, and candelas per meter squared mean?

3. How do we measure the strength of a source of light?

4. Why is the pupil of the eye black, but glows red in photographs?
Lecture 4
1. How does an ophthalmoscope work? What does it do?
2. Be able to compute the visual angle of a stimulus when given it’s physical size and distance from the eye.
3. Discuss the blind spot experiment in CogLab and the results found for the class average. Where the data what we expected? Were there any deviations from what was expected?

Lecture 5
1. What do the numbers in 20/20 vision mean?
2. Why is the world not upside down, small, reddish, blurry, or filled with holes?
3. Describe the difference of Gaussians model of ganglion receptive fields. What exactly is being modeled?

Lecture 6
1. Explain how a ganglion cell’s response is computed with the difference of Gaussian’s model.
2. Discuss how the ganglion cell’s response varies with different stimuli.
3. Explain how a layer of activity allows us to “see” the activity pattern of ganglion cells.
4. How do ganglion cell responses depend on the size of the receptive field?
5. How do ganglion cell responses provide an explanation of the brightness contrast illusion?
6. How do ganglion cell responses provide an explanation of the Hermann grid illusion?

Lecture 7
1. How does the visual cortex represent information about visual stimuli?

Lecture 8
1. What does Fourier analysis do?
2. What do we mean when we say that a function can be described in terms of space or in terms of Fourier components?

Lecture 9
1. What is the contrast sensitivity function, and how does it depend on spatial frequency?

Lecture 10
1. How do the responses of ganglion cells provide a partial explanation of the Crak-O’Brien-Cornsweet illusion?
2. How do the responses of orientation sensitive cells in visual cortex provide a partial explanation of the perceived orientation of Glass patterns?

Lecture 11
1. How does a neuroscientist identify the “critical features” that drive a neuron that responds to complex forms.

2. Be able to describe face adaptation effects and what they mean about the representation of faces in visual cortex.

**Lecture 12**

1. Why might cells in IT respond best to such odd kinds of stimuli?
2. How might Fourier analysis provide features for object representation?

**Lecture 13: Signal Detection Theory**

1. What is the difference between perception and recognition? Give an example.
2. What are some problems with the “traditional” psychophysical methods of measuring a threshold?
3. Describe the important parts of a discrimination task. How is it that stimulus thresholds involve a discrimination task? What are the kinds of responses that can be made by a subject?
4. Explain how bias may change the reports of subjects in a discrimination task, even if stimulus sensitivity is unchanged. Explain how bias functions in signal detection theory.
5. Explain what \( d' \) in signal detection theory measures and how it corresponds to sensitivity to the stimulus in the context of noise.

**Lecture 14: Gestalt Psychology**

1. Describe the ideas of structuralism and the problems with this approach.
2. Describe the Gestalt laws of perceptual organization.
3. Explain how impossible figures are difficult to accept in the context of some of the Gestalt laws of perceptual organization.

**Lecture 16: Figure-ground / Object features**

1. Explain the distinction between figure and ground in a scene. Describe the stimulus features that tend to make a stimulus seem to be figure rather than ground.
2. Describe the visual search task (as in CogLab) and explain how the pattern of responses allows us to investigate object perception
3. Describe the Feature Integration Theory of visual perception and explain how it accounts for the visual search data.
4. What is a geon? What special properties does it have that might not be part of just any stimulus? What is a geon used for?

**Lecture 17: Color perception**

1. Explain the relationship between the wavelength of light and the perception of color.
2. Describe Helmholtz’s color matching experiment and how the results gives rise to the trichromatic theory of color perception.
Lecture 18: Opponent theory
1. Discuss the properties of color perception that suggest an opponent relationship between “opposite” colors.
2. Explain how trichromatic theory and the opponent theory of color perception co-exist.

Lecture 19: Constancy
1. What is brightness constancy? How is it related to illusions like the “Snakes” illusion?

Lecture 20: Monocular cues to depth
1. Describe the basic problem with perceiving depth given how light projects on to the retina.
2. Explain how the convergence and accommodation oculomotor cues can provide some information about object depth.
3. Be able to describe and give an example of each of the monocular cues to depth.

Lecture 21: Binocular cues to depth
1. Explain motion parallax and how it is a cue to depth.
2. Describe the horopter.
3. Explain the difference between crossed and uncrossed disparity and their relationship to dept.
4. Describe a random dot stereogram and explain why it’s ability to create a depth percept is important.

Lecture 22: Size perception
1. Explain size-distance scaling. How does it explain Emmert’s Law?
2. Describe the Muller-Lyer illusion and discuss it’s relationship to size-distance scaling.
3. Describe the moon illusion and give the explanation that was discussed in lecture.

Lecture 23: Motion perception
1. Describe the stimulus used to create apparent motion. Explain how the perceptual experience changes with the timing between stimuli.
2. Explain how a Reichardt detector (not the kind discussed in the textbook) detects motion in a particular direction.

Lecture 24: Motion perception
1. Discuss some of the difficulties in motion organization. Focus the discussion on either the aperture problem, or on apparent motion.
2. Discuss the relationship between eye movements and motion perception.
3. Why does an afterimage appear to move as you move your eyes?

Lecture 25: Flow fields
1. Explain what a flow field is. Give two examples of what a flow field would look like for two situations.

2. What is the focus of expansion in a flow field? Explain how it could be used to guide behavior.

**Lecture 26: Action and perception**

1. What information does \( \tau \) (tau) provide? How is \( \tau \) computed?

2. How do we know that flow fields influence how people behave in an environment? Give two examples.

**Lecture 27: Stimulus-response**

1. Describe the Simon Effect experiment, including the stimuli, task, and typical results.

**Lecture 28: Sound**

1. Describe the use of the term *decibel* as a measurement of sound amplitude. Give the mathematical formula and explain the terms.

2. What does Fourier analysis demonstrate about complex sounds?

**Lecture 29: Auditory physiology**

1. Sketch (roughly) the audibility curve and explain what it tells us about human hearing.

2. Describe the basic anatomy of the auditory system. Explain how sound transfers from one part to the next, up to the basilar membrane.

3. Describe the structure and function of the organ of Corti as it responds to sound stimuli.

**Lecture 30: Auditory Physiology**

1. Describe the *place theory* for coding frequency on the basilar membrane. Be sure to discuss the traveling wave and the wave envelope.

2. How are tuning curves and auditory masking studies consistent with the place theory for coding frequency?

**Lecture 31: Sound localization**

1. Describe two ways the auditory system estimates azimuth location of a sound source.

2. Explain how the auditory system estimates elevation location of a sound source.

3. Describe two ways the auditory system estimates distance of a sound source.

4. Describe the precedence effect on sound source location.

**Lecture 32: Sound quality**

1. Explain why a recording of a piano played backwards does not sound like a piano.

2. Describe two methods used by the auditory system to achieve auditory stream segregation.

**Lecture 33: Touch**
1. Know the four types of mechanoreceptors that are involved in touch. For each one be able to describe what kind of touch stimulus it is most responsive to. Also be able to describe its adaptation, temporal, and spatial (receptive field) properties.

2. What advantage do the letters of the Braille alphabet have over traditional (Roman) letters?

Lecture 34: Touch and pain

1. Be able to describe a phantom limb and it’s relationship to somatosensory cortex.
2. Describe the representation of touch information in somatosensory cortex.
3. Why is tickling more effective when done by someone other than yourself?
4. Describe the gate control theory of pain perception. Explain why it helps to rub a spot that has been injured.

Lecture 35: Olfaction

1. Describe the relationship between molecular shape, receptor shape, and olfaction.

Lecture 36: Taste

1. Describe the contribution of taste, olfaction, and temperature to the perception of flavor.