

LDA-C5011 Cognition and Brain Function

Twenty questions exam 5cr

This Exam is elective in the LDA-C500 Cognitive Science module, the DATA-15000 Computers and Cognition module and KIK-KK100 Communication & Cognition module. In the old-type curriculum CogSci minor, it can be substituted for Cog115, Cog151 and Cog152. NOTE: even if you have taken any or all of these, you can still take this exam, too!

The exam is based on Glass, A.G. (2016): *Cognition: A Neuroscience Approach*, Cambridge University Press, Ch. 1-6, Ch. 10-11 & Ch. 15.

Two of the questions 1-17 will be randomly selected for answering in the exam. In addition, randomly selected parts of questions 18 – 20. Your answers should be given in plain text form (“essay-type”, not bullet points). You will have three hours in the exam.

Study hint: You may want to print out each question at the top of a separate blank sheet of A4 paper, and then add your notes and comments to the sheets as you go along (filling the other side or more paper if needed!). Then, once you’ve gone through the chapters you can continue working on highlighting and organizing and expanding on your notes, and cross-referencing the answers. You will be using the notes as your primary study material, returning to the book (or other sources) just to check things or fill in things you might have missed, if needed.

The Questions:

1. Give two examples of a reflex. One that is a spinal reflex where the reflex arc does not go through the brain, and another that is a cranial reflex that does not go through the spinal cord. Describe the stimulus, response and organization of the “reflex arc”.
2. What is meant by conditioning of responses? Give two concrete examples: a lab paradigm and a natural environment (non-lab) example.
3. What kind of neural plasticity is LTP? What other forms of neural plasticity are there (name and describe two)?
4. What roles do the prefrontal cortex, posterior parietal cortex and basal ganglia play in motor planning?
5. What kinds of feedback does the brain have available to control complex motor actions? Discuss via (a) concrete example(s).
6. Fitts’ law can be stated

$$T = a + b \log_2(2D/W)$$

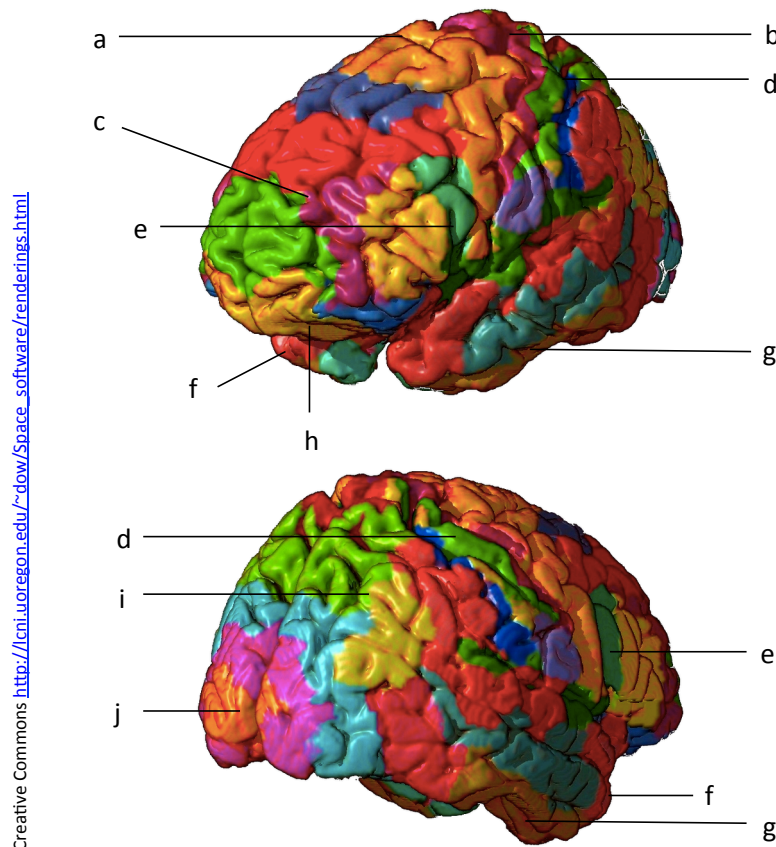
What does it mean? Walk through the equation - i.e. identify the concepts represented by symbols – "what is being computed" - and explain the formal relationships in terms of content and qualitative reasoning (proportionality, inverse proportionality, dependencies, independencies, orders of magnitude, and/or examples, anything that makes sense out of the equation for you).

7. How is visual search for featural targets different from visual search for conjunctive targets. Also discuss what a "visual feature" is in the first place.
8. Describe the overall organization of the visual system, in terms of neural pathways for both sensory (afferent) and motor (efferent) signals.
9. What is a receptive field? How are receptive fields of lateral geniculate nucleus and primary visual cortex cells organized?
10. Describe ways in which hemispheric lateralization of function manifests in speech, gesture and awareness.
11. What kinds of mnemonics can be used to extend memory for arbitrary materials? Discuss what these might reveal about the organization of human memory and its workings for more natural everyday materials.
12. Recognition of pictures, sounds and faces – some remarkable long-term memory feats of the human brain. Discuss.
13. Research on specially designed laboratory reasoning tasks has revealed a number of consistent and systematic (at least in western university students) biases and fallacies in reasoning with symbolically presented logical or probabilistic information. Name and explain three examples.
14. Savantism and expertise are both displays of exceptional skill – but how do the phenomena (and the underlying skill acquisition processes) relate and differ. Discuss.
15. Choose one everyday task that you do regularly (e.g. in a hobby of yours), and discuss its possible neurocognitive basis. That is, try to analyze what brain systems you might be employing in task performance, and what specific aspects of behavior, perception, memory... they would support. (It's ok to be speculative; the important thing here is to try to make your assumptions and hypotheses as *clear* as possible, not as factually *certain* as possible).
16. Which cognitive phenomena, experimental findings or facts about brain function do you find the most fascinating (does not need to be discussed in the book)? Why?
17. Is the view of human behavior and its perceptual-cognitive underpinnings (including what we are and are not aware of) that is offered by a neuroscience perspective substantially different from what everyday experience and introspection suggests? In what ways? Discuss.

18. Below are listed a number of *subcortical* areas. Indicate for each what perceptual, cognitive or motor systems (or functions) they are traditionally associated with.

Amygdala
Basal ganglia
Cerebellum
Hippocampus
Hypothalamus
Inferior colliculus
Lateral geniculate nucleus
Medial geniculate nucleus
Superior colliculus

19. In the figure are indicated ten cortical areas. Name them (NB. they are also in the list in question 20)



20. Below are listed a number of *cortical* areas. Indicate for each what perceptual, cognitive or motor systems (or functions) they are traditionally associated with.

Anterior cingulate gyrus
Anterior temporal cortex
Inferior frontal gyrus (ventrolateral prefrontal cortex)
Inferior temporal cortex

Orbitofrontal cortex

Postcentral gyrus

Posterior parietal cortex

Precentral gyrus

Primary visual cortex (V1)