Bi/CNS/NB 150

Problem Set 5

Due: Tuesday, Nov. 24, at 4:30 pm

Instructions:

1) Drop off in the Bi 150 box outside Baxter 331 or e-mail to the head TA (jcolas).

2) Submit with this cover page.

3) Use a separate sheet of paper for each problem.

4) Type all answers if possible.

5) Use complete, grammatically correct sentences.

6) Include your name and the page number on every page.

7) Note that late problem sets receive a 10% deduction for every day past the due date.

Name:

Time and date submitted:

Total pages (including cover page):

Comments:

Problem 1 grade:

Problem 1 comments:

Problem 2 grade:

Problem 2 comments:

Total grade:
Problem 1 (1.5 points): Sensorimotor systems

Problem 1.A (0.4 points): Sense of self

1.A.a. Even with your eyes closed, you generally still know where your arms and legs are located. How can you know the position of your body without looking? Name the sensory modality used for this and briefly describe the peripheral mechanism for sensing it.

1.A.b. Describe the most relevant pathway that mediates this sensory modality. Include every step as you trace the pathway from the periphery to cerebral cortex. Provide the specific names of the structures involved at each stage of processing. Also state if any connection crosses to the other side of the body or brain. Alternatively, you can draw a detailed diagram of the pathway and clearly label the stages of processing.

Problem 1.B (0.3 points): Two-point discrimination

1.B.a. A test of two-point discrimination examines one’s ability to discriminate touching at two different points from touching at one point. Which part of the body would be most sensitive for such discrimination? Justify your answer.

1.B.b. How can this fine sensitivity be achieved? Describe at least two distinct properties that contribute to better two-point discrimination.

Problem 1.C (0.4 points): Pathways

1.C.a. A doctor is examining a patient with a complete lesion of one half of the spinal cord only at the L1 level. The patient has paralysis in the left leg. Which pathway on which side of the spinal cord is damaged?

1.C.b. Next, the doctor checked whether the patient could feel pain at each part of the body. Does the patient have difficulty sensing pain? If so, state which part of the body has the defect and describe the relevant pathway.

1.C.c. Finally, the doctor checked whether the patient could feel touching with a fine hairbrush at each part of the body. Does the patient have difficulty sensing touch? If so, state which part of the body has the defect and describe the relevant pathway.
Problem 1.D (0.4 points): Comparisons across systems

Rank the sensory systems underlying vision, audition, olfaction, and somatosensation in order from least to most with respect to each of the following criteria. Explain the reasoning behind the rankings.

1.D.a. Temporal acuity (i.e., how precisely in time the system can detect stimuli)

1.D.b. Spatial acuity (i.e., how precisely in space the system can detect stimuli)

1.D.c. Relative importance to humans (i.e., the degree of impairment to everyday life that would result from loss of the system)

1.D.d. Amount of primary sensory neocortex devoted to the system in humans
Problem 2 (1.5 points): Learning & Memory

Problem 2.A (1.0 points): Taxonomy

2.A.a. Define episodic memory and semantic memory.

2.A.b. Provide an example of each of these two types of memory and explain what about the examples determines their inclusion in either category.

2.A.c. Which broader category of memory do these two types fall under?

2.A.d. Where specifically would a brain lesion most selectively impair episodic memory?

2.A.e. Where specifically would a brain lesion most selectively impair semantic memory?

2.A.f. Define associative learning and non-associative learning

2.A.g. Categorize each the following types of learning as either associative or non-associative: sensitization, habituation, classical conditioning, and operant conditioning.

2.A.h. Define each of the aforementioned four types of learning and provide examples of how each would be demonstrated in an experiment. Emphasize what is unique about each type. Describe what you would do and what you would measure in the experiment.

2.A.i. What is the most obvious difference in recollection between the two major types of memory described in 2.A.a. and 2.A.g.?

Problem 2.B (0.5 points): Temporal aspects

2.B.a. Name and briefly describe at least four distinct stages in time at which learning and memory operate.

2.B.b. What are the differences among iconic memory, short-term memory, working memory, and long-term memory? Include the time scales over which each of these different forms of memory are active and the region(s) of the nervous system responsible for them in humans.