

### Homework 3: Reading Questions and Exercises

**Due:** Monday, October 8

Submit computer-formatted, spell-checked, proofread answers to the following questions.

1. Give short (1 or 2 sentence) descriptions of Vehicles 4a and 4b. What types of behaviors are made possible by does using a non-linear and discontinuous excitation (or inhibition) function as opposed to a linear and continuous one?
2. Explain (in a few sentences) how the networks in Figures 10a and 10b enable Vehicle 5 to “count”.
3. What is the role of the discount factor  $\gamma$  in reinforcement learning? What happens if you set it to 0? What happens if you set it to 1?
4. What is the role of the “learning rate”  $\eta$ ? What problem might arise if it were set too low? What problem might arise if it were set too high?
5. Choose a heuristic for A\* search on the 8-puzzle. Specify an initial state and a goal state and show how A\* would search the state space for 3 levels below the initial state. Is your heuristic admissible? Why or why not?
6. Try playing the “coins” game described at <http://cognitrn.psych.indiana.edu/nsfgrant/coins/> (using the applet labeled “Launch Coins”). Suppose you were writing a program to learn to play this game using reinforcement learning. How would you specify (1) the state space; (2) the list of possible actions; and (3) the reward function? (There are many possible correct answers.)
7. Choosing an action-selection method and an initial starting state, hand-trace the states and actions that might explored by your (hypothetical) reinforcement learner over three games between the program and you, and give the final Q values for those state-action pairs that would be obtained through Q learning. Assume both the learning rate and the discount factor are equal to 1.