CS 491/691X – Topics: Introduction to Robotics

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Homework #1

Due: February 24

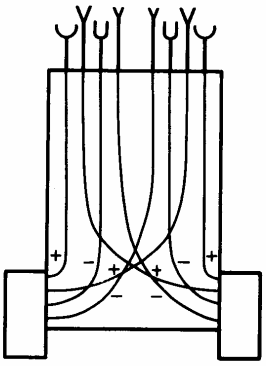
1. [5 points] Describe at least 2 differences between the AI and the cybernetics/control theory approaches to robotics.

2. [5 points] Explain the difference between the sensory (perceptual) space and the state space of a robot.

3. [10 points] How would you measure a robot's (stall) torque? How about its speed?

4. [10 points] List at least one advantage and one disadvantage of each of the four robot control paradigms: reactive, deliberative, hybrid, behavior-based.

5. [10 points] The following Braitenberg vehicle has 4 pairs of sensors tuned to different qualities of the environment: light, temperature, oxygen concentration, amount of organic matter. The first pair is connected to the motors with uncrossed excitatory connections, the second pair with crossed excitatory connections, the third and the fourth pairs with inhibitory connections uncrossed and crossed. Describe the behavior of this Braitenberg vehicle.



6. [10 points] You are to design the sensor capabilities for a new robot for use by fire fighters. The robot is designed to seek out people in a smoke filled building. Keep in mind the following:

a) Visibility is often very limited due to smoke

b) Heat can be both an attractive force (e.g. human) or repulsive (e.g. open flame)

c) Obstacles may have a wide variety of sound absorption (e.g. carpeting or furniture)

Describe the types of sensors that may be needed and how they will be used. Do not focus on how the robot moves around, just on the sensors it will need to use.