

COMP 4500, Mobile Robotics I  
Spring 2018  
Prof. Yanco

### Sample Exam

**What might be on the exam, which will be held in class on Thursday 4/19:**

- Material from lectures: Robot morphologies, sensors and motors; Braitenberg vehicles; Robot architectures; Localization and mapping; Swarms; Vision; Robot learning
- Material from readings (Braitenberg, Murphy Chapters 2 (Deliberative Architectures), 4 (Reactive Architectures) and 7 (Hybrid Architectures), Russell & Norvig's Reinforcement Learning chapter)
- Material from labs: how to use sensors and motors, how to program the robots, how to design robots, etc.

**Problem 1 (10 points): Definitions**

Define the following terms in one or two sentences:

a) Emergent behavior

b) Blob detection

**Problem 2 (25 points): Robot Architectures**

a) Draw the relationship between the SENSE, PLAN, and ACT primitives for the hierarchical paradigm.

b) Draw the relationship between the SENSE, PLAN and ACT primitives for the reactive paradigm.

c) Draw the relationship between the SENSE, PLAN and ACT primitives for the hybrid paradigm.

**Problem 2 (continued): Robot Architectures**

d) Briefly discuss one advantage that the reactive paradigm has over the hierarchical paradigm.

e) Briefly discuss one advantage that the hierarchical paradigm has over the reactive paradigm.

**Problem 3 (10 points + 3 extra credit): Reactive Paradigm**

a) State the name of an implementation of a reactive architecture.

b) Explain how behaviors are combined in the implementation you picked.

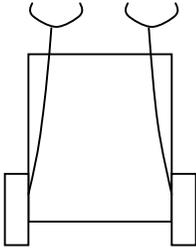
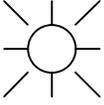
c) Extra credit: Name the creator of the implementation you have named.

**Problem 4 (20 points): Robot programming**

Write code for a Wallaby-based robot that will back up and turn in place when both bumpers are hit at the same time. The left motor is in motor port 0, the right motor is in motor port 2, the left bumper is in digital port 9, and the right bumper is in digital port 10.

**Problem 5 (20 points): Braitenberg Vehicles**

a) What does the following Braitenberg vehicle do?



b) Write Wallaby code to implement the vehicle above. Assume that the left light sensor is plugged into analog port 3, the right sensor is in analog port 4, the left motor is in motor port 0 and the right motor is in motor port 2. Keep in mind that the motor speed should be proportional to the amount of light read by the sensors.

**Problem 6 (15 points): Robot Parts**

a) If a motor is spinning in the wrong direction (e.g., your robot goes backward when you're expecting it to go forward), list two ways that you could fix the problem.

b) List three sensors that can be used for sensing distance. Briefly describe how each works and if there are any drawbacks to using each sensor in particular conditions.