

91.549, Mobile Robots
Fall 2004
Prof. Yanco

Take-Home Exam

Out: Thursday, 9 December 2004
Due: Tuesday, 21 December 2004 by 4:00pm

This exam is open book, open notes, and open web. However, you should not plagiarize any portions of your exam. Cite appropriately and write your own words.

You may take as much time as you like on the exam, although it should not take more than a couple of hours.

Complete this exam by yourself, without discussing any questions with your fellow students. Sign the line below to certify that you did not discuss the exam with fellow students or get answers from anyone. (Turn this page in with your answers.)

Signature: _____

Problem 1 (5 pts): Describe the difference between horizontal and vertical behaviors. Give an example of each.

Problem 2 (5 pts): List and describe two methods of blending behaviors.

Problem 3 (5 pts): What problems can arise with sonar sensors?

Problem 4 (5 pts): Explain the differences between quantitative and qualitative maps.

Problem 5 (10 pts): How do odometry errors affect mapping? How can these problems be avoided?

Problem 6 (5 pts): Describe a function that can not be represented by a perceptron.

Problem 7 (15 pts): Write behavior based control code using fuzzy rules to search for open space in front of the robot and move towards it. You do not need to worry about obstacle avoidance or backing up. Have your robot stop if all front sensors read closer than 1 robot length.

Problem 8 (15 pts): Recall the person or trash can following robot program that you wrote in Lab 1. Instead of writing a direct control program to follow a person or trash can at a specified distance (turning as needed), describe how to set up reinforcement

learning to solve the problem. You do not need to write the code to perform the learning. Instead, describe the state space and your reinforcement function.

Problem 9 (10 pts): Describe a domain for which multiple robots must (or should) be used. Describe the interaction needed between the robots.

Problem 10 (10 pts): What do you think is the most important technical obstacle to the success of mobile robotics? Describe how you think this problem may eventually be resolved, assuming that it will be. What do you think the time line will be for this progress?

Problem 11 (5 pts): What do you think is the greatest non-technical obstacle to the widespread adoption of mobile robotics technologies? Discuss the issues involved and how you expect things to unfold.

Problem 12 (10 pts): Suggest an unexploited application domain for mobile robots. Propose an approach.