Student Name: _____ Student ID # _____

Question 1: Functional Modules vs. Behaviors. 20 points.

Imagine the following situation. Bender (a robot) is on the fifth day of a trip to the planet Ffup, a planet about which his maker had no knowledge. For that matter, Bender didn't know anything about local customs when he got here five days ago. Now he is running low on fuel. Unfortunately for him, he runs on alcohol, today is the Feast of Xeneel (a local holiday), and all the local liquor stores are closed due to the holiday.

A. Do you think Bender would be more likely to find himself in this situation if he had been designed using the functional modules approach or the behavior-based approach? **Explain your answer.**

Imagine that Bender survives his little predicament, above, but finds himself in exactly the same predicament the very next year.

B. Do you think Bender would be more likely to find himself in this situation a second time if he had been designed using the functional modules approach or the behavior-based approach? **Explain your answer.**

Question 2: The Subsumption Architecture. 20 points.

On page 20 of "A Robust Layered Control System for a Mobile Robot," Brooks says that he is "not completely happy with the fact that a level *0* module has an output (the motor-status output of the **motor** module) which is not used within that level but only in level *2*."

A. Why is he not completely happy about this? **Explain your answer.**

I pointed out in class that I am not completely happy with the fact that in level 0 of Brooks' example (shown on 15 of his paper and page 116 of the Murphy text), one path from the sonar to the motors contained more modules than the other.

B. What was my explanation for why I'm not completely happy about this? **Explain your answer.**

Question 3: Subsumption, Schema Theory, and Potential Fields. 30 points.

A. Does the subsumption architecture provide us with mechanisms for creating individual behaviors, doing behavior fusion, both, or neither? **Explain your answer.**

B. Does schema theory provide us with mechanisms for creating individual behaviors, doing behavior fusion, both, or neither? **Explain your answer.**

C. Does the potential fields methodology provide us with mechanisms for creating individual behaviors, doing behavior fusion, both, or neither? **Explain your answer.**

Question 4: Potential Fields. 10 points.

You find that your robot, which uses potential fields for moving to the goal and avoiding obstacles get stuck when going through doorways. What happens is that, when the robot gets close to the doorway, the potential fields from the door frame sum with the potential field from the goal to produce a zero value as shown in Figure 1.

Figure 1: Potential fields and doorway navigation. Potential fields between robot (R) and Goal (G), showing summation to zero at black dot.

A. *Without changing how either of these fields is calculated* and sticking to a purely reactive paradigm, **explain** a way in which you can have your robot get out of this null spot and through the door successfully.

B. Is your method safe? **Explain your answer.**

Question 5: Sensor Fusion vs. Sensor Fission. 10 points.

Consider the paper "From Task Level Planning To Analogical Navigation" by Mowforth and Grant.

A. Does this paper contain any examples of sensor fusion? **Explain your answer.**

B. Does this paper contain any examples of sensor fission? **Explain your answer.**

Question 6: The CMUcam. 10 points.

Given what Prof. Miller told us about the CMUcam on Wednesday, would it make more sense to consider this a sensor or a perceptual unit? **Explain your answer.**