## Homework 1: *AI and Agents*

## **Due:** Thursday, Sept. 5<sup>th</sup>, at beginning of class (11:10AM) (Either bring hard copy to class or submit to Blackboard)

[Note that undergrads and grads have a different problem #4.]

- 1. **[Everyone]** For each of the following assertions, say whether it is true or false and support your answer with examples or counterexamples where appropriate.
  - a) An agent that senses only partial information about the state cannot be perfectly rational.
  - b) There exist task environments in which no pure reflex agent can behave rationally.
  - c) There exists a task environment in which every agent is rational.
  - d) The input to an agent program is the same as the input to the agent function.
  - e) Every agent function is implemented by some program/machine combination.
  - f) Suppose an agent selects its action uniformly at random from the set of possible actions. There exists a deterministic task environment in which this agent is rational.
  - g) It is possible for a given agent to be perfectly rational in two distinct task environments.
  - h) Every agent is rational in an unobservable environment.
  - i) A perfectly rational poker-playing agent never loses.
- 2. **[Everyone]** For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties listed in Section 2.3.2:
  - a) Playing soccer
  - b) Exploring the subsurface oceans of Titan
  - c) Shopping for used AI books on the Internet
  - d) Playing a tennis match
  - e) Practicing tennis against a wall
  - f) Performing a high jump
  - g) Knitting a sweater
  - h) Bidding on an item at an auction
- 3. **[Everyone]** Consider a modified version of the vacuum environment that is stochastic, instead of deterministic. Discuss possible agent programs for each of the following stochastic versions:
  - a) Murphy's law: 25% of the time, the *Suck* action fails to clean the floor if it is dirty and deposits dirt onto the floor if the floor is clean. How is your agent program affected if the dirt sensor gives the wrong answer 10% of the time?

- b) Small children: At each time step, each clean square has a 10% chance of becoming dirty. Can you come up with a rational agent design for this case? Explain.
- 4. [*Undergraduates only*] Various subfields of AI have held contests by defining a standard task and inviting researchers to do their best. Examples include the DARPA Grand Challenge for robotic cars and the Loebner Prize in AI (for the Turing Test). Find 2 other contests in AI (other than the DARPA Grand Challenge and the Loebner Prize) and describe (in 1-2 paragraphs) the progress made in that competition over the years. Describe the degree to which the contests have advanced the state of the art, and the degree to which the competitions might have hurt the field by drawing energy away from new ideas.
- 4. [*Graduate students only*] Read Turing's 1950 article "Computing machinery and intelligence", *Mind*, 59, 433-460 [posted on our course website, under "Homework Assignments"].
  - a) What do you find to be the most interesting philosophical issue raised by Turing in this article regarding the development of "thinking" machines? (Answer in 1-2 sentences, citing location(s) in the article where Turing discusses this issue.)
  - b) Provide a brief discussion (1-2 paragraphs) of this philosophical issue from your perspective, and why you find it to be compelling and interesting. (There is no right or wrong answer here. I want to see that you've thought about an interesting philosophical point that Turing has raised regarding "thinking" machines.)