CS331 (Spring 2016): Introduction to Artificial Intelligence
Written Assignment #1

Date handed out: March 30, 2016
Date due: April 6, 2016 at the start of class
Total: 25 points

The written portion of this assignment is to be done individually. Please hand in a hardcopy. Assignments done on a word processor are preferred but not mandatory. For hand written assignments, if we cannot read your writing, we cannot mark your assignment.

1. You will be answering parts (a)-(c) for an agent that controls the traffic lights at a 4-way intersection (where 2 roads cross, with traffic flowing in all directions). The lights have green/yellow/red main lights plus a left-turn arrow and a pedestrian indicator. The agent controls which lights go on and how long they stay on. Assume the intersection has signals for pedestrians and in-pavement detectors right before the crosswalk for cars and bikes. [11 pts].

a) Develop a description of the task environment using the PEAS description i.e.:

- Performance
- Environment
- Actuators
- Sensors

b) Then describe the environment according to the following properties:

- fully vs partially observable
- deterministic vs stochastic
- episodic vs sequential
- static vs dynamic
- discrete vs continuous
- single vs multi-agent

Note that in some cases, both answers might be correct. Justify each answer to the task environment properties with a one sentence explanation.

c) Suggest the most appropriate agent design by choosing the most appropriate of the following agent types:

- simple reflex agent
- model-based reflex agent
- goal-based agents
- utility-based agent

Justify your answer with a one sentence explanation.

2.(Exercise 2.3a-d in the book) For each statement, say whether it is true or false. Provide a one-sentence example, counterexample, or justification.

a) An agent that senses only partial information about the state cannot be perfectly rational. [2 points]

b) There exist task environments in which no pure reflex agent can behave rationally. [2 points]

c) There exists a task environment in which every agent is rational. [2 points]

d) The input to an agent program is the same as the input to the agent function. [2 points]

3. (Exercise 2.10a-c in the book) Consider a modified version of the vacuum environment:

- Performance measure: one point awarded for each clean square at each time step and one point penalized for each movement
- Environment: map is known *a priori* (squares A and B as in class and Figure 2.2), dirt distribution and initial location are unknown. Clean squares stay clean.
- Actuators: Suck cleans dirt, Left moves left, Right moves right.
- Sensors: Location and dirt sensors.

a) Can a simple reflex agent be perfectly rational for this environment? [2 points]

b) What about a reflex agent with state? Describe such an agent. [2 points]

c) How do your answers to *a* and *b* change if the agent's percepts give it the clean/dirty status of every square in the environment? [2 points]