Samuel Steiner
Problem Set 1

1) Are reflex actions (such as flinching from a hot stove) rational? Are they intelligent?

Reflex actions are rational they take in some precept and react in a way that they believe will create a desirable outcome. In the scenario of flinching from the hot stove, the action hopes to minimize harm caused by removing the agent from danger. Whether they are intelligent is debatable. Since reflex actions don't take into consideration the past actions taken or try and model the state of the environment it can be said they are not intelligent since they don't learn from their actions. It could also be said since the agent takes in precepts and reacts accordingly this could be intelligent.

2.3) 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

False, a good example of this is the vacuum agent which does not observe the spaces around it but is able to act rationally.

b) *There exist task environments in which no pure reflex agent can behave rationally.*

True, environments which require memory would be problematic for pure reflex agents as they do not have the ability to remember past actions.

c) *There exists a task environment in which every agent is rational.*

True, an environment in which no matter the action the same outcome and reward are provided would be an environment in which no matter the agent it would be rational.

d) *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.*

True, the environment described in c would be an environment where this agent would be rational as all agents would be rational in that environment.

e) *It is possible for a given agent to be perfectly rational in two distinct task environments.*

True, an agent which bets on the outcome of a coin flip in an environment which the coin is weighted towards heads and an environment which there is no bias the agent which bets head on every flip would be rational as the probability of getting either heads or tails in the fair environment are equal.

f) *Every agent is rational in an unobservable environment.*

False, since part of rationality is prior knowledge an agent with prior knowledge could act rational while one without may not act rationally. An example of this is if a vacuum agent with no knowledge does nothing while one with knowledge continually moves and cleans.

g) *A perfectly rational poker-playing agent never loses.*

False, a good example of a rational poker agent losing is if it was facing off against another rational poker agent (heads up poker, etc). One agent must lose. This is the case because of the stochastic (luck) based element of the deck.

2.4) For each of the following activities, characterize the task environment it in terms of the properties listed above

a) *Playing soccer.*

- fully observable
- multiagent
- stochastic
- dynamic
- continuous

b) *Exploring the subsurface oceans of Titan.*

- partially observable
- Single agent
- stochastic
- dynamic
- continuous

c) *Playing a tennis match.*

- fully observable
- multiagent
- stochastic
- dynamic
- continuous

d) *Practicing tennis against a wall.*

- Fully observable
- Single agent
- stochastic
- dynamic
- continuous

e) *Performing a high jump.*

- Fully observable
- Single agent
- deterministic
- dynamic
- continuous

f) *Knitting a sweater.*

- Fully observable
- Single agent
- Deterministic
- Static
- continuous

3.2 Your goal is to navigate a robot out of a maze. The robot starts in the center of the maze facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance, although it will stop before hitting a wall

a) *Formulate this problem. How large is the state space?*
The state space for this problem can be described by each space which there is no wall in the maze that is reachable and each of the 4 cardinal directions. If labeled, the number each reachable space, as S then the state space is 4S

b) *In navigating a maze, the only place we need to turn is at the intersection of two or more corridors. Reformulate this problem using this observation. How large is the state space now?*

Since the robot only needs to turn if there is an intersection it does not need to check all states where there is no intersections the agent will either be going one of 2 directions in a corridor with no intersection and any 4 of the cardinal directions at the intersections. The state space for this if the number of intersections is labeled as I, is 4I + 2(S-I) the reason use 2(S-I) is because for those spaces which are not intersections there are 2 states.

c) *From each point in the maze, we can move in any of the four directions until we reach a turning point, and this is the only action we need to do. Reformulate the problem using these actions. Do we need to keep track of the robot's orientation now?*

Since the only actions are turning and moving at intersections and each move can be described with a direction such as move north, move south so on so forth. Keeping track of the direction is not needed.

d) *In our initial description of the problem we already abstracted from the real world, restricting actions and removing details. List three such simplifications we made*

1) the robot can sense walls always
2) the robot can only face in the 4 cardinal directions and move
3) The robot can be certain that it is moving the exact distance it wants to move