**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

## Assignment: Intelligent Agents

| Assignment | Problems | Date Due |
|---|---|---|
| A-3 | Agent-1 through Agent-5 | *Solutions* |

*Note: This solution set presents a simplified version of possible answers to the questions. Your answers will depend upon the assumptions you have made (and stated) when analyzing the problems. Your solutions (hopefully!) will be more detailed, with examples, explanations and justifications to clearly convey your depth of knowledge.*

Agent-1. Consider the following PEAS description of an agent that reports threat of tsunami activity:

| **Tsunami Activity Reporter**[1] | |
|---|---|
| **Performance Measure:** | Inform seismologists and coastal residents of the possibility and/or appending approach of a tsunami. |
| **Environment:** | Series of buoys (sea-level monitoring equipment) in the oceans of the world. |
| **Actuators:** | When readings match one of the recognized patterns of wave movement and related seismic activity has been detected, notify seismologists and residents of coastal areas which will most likely be affected by a possible significant event. Provide estimate of time it will take the tsunami to reach each potentially affected area, and estimate of wave height and intensity. |
| **Sensors:** | Continuous readings from sensors strategically placed throughout the world's oceans. |

Determine what type of agent architecture is most appropriate (table lookup, simple reflex, goal-based, or utility-based). Give a detailed explanation and justification of your choice.

*The patterns which the agent uses are matched against sets of events that occur over time. Therefore, the agent needs to maintain knowledge of the past, and, thus, cannot be either a table lookup or simple reflex agent. If you assume that the patterns do not overlap and are clearly distinguishable from one another, then the agent could be viewed as goal-based. On the other hand, if you assume that the patterns do overlap, and that one must consider such factors as the likelihood of one event occurring over another, then the agent would be viewed as utility-based.*

Agent-2. Describe the (internal) evaluation function that might be used by the Tsunami Activity Reporter. Is it a static or a dynamic evaluation function?

*(R&N p.51) The Tsunami Activity Reporter (TAR) needs to look at several sensor readings and readings from buoys and seismographs over a period of time to make a decision. The cumulative nature of the decision requires a dynamic evaluation function, rather than a static one.*

[1] Refer to attachment #1 for a more complete description.

Agent-3. Assume that you designed a utility-based agent for the Tsunami Activity Reporter (whether or not the problem warrants it). Describe the utility function that it might use.

*The utility function is internal to the agent. It selects action(s) to take after considering the several possible patterns.*

Agent-4. What (external) performance measures would you recommend for your Tsunami Activity Reporter?

*(R&N p. 35) The performance measure exists outside the agent to determine the agent's overall effectiveness. Possible measures for the TAR: number of tsunamis accurately predicted, fatalities or number of lives saved, property damage estimates.*

Agent-5. Describe the properties of the environment of the Tsunami Activity Reporter in terms of the principal distinctions we can make (accessible vs. inaccessible, deterministic vs. nondeterministic, episodic vs. nonepisodic, static vs. dynamic vs. semidynamic, discrete vs. continuous). That is, identify in detail which properties are characteristic of the environment described, and give a justification for your description.

*Accessible vs. inaccessible or fully vs. partly observable: Does the agent have access to all of the relevant environment?*

*Inaccessible or partly observable: The agent sees only one sensor reading at a time, whereas the relevant state includes a series of readings to determine velocity and direction. The agent needs to maintain an internal state to keep track of how the current readings fit into evolving patterns.*

*Deterministic vs. Stochastic: Is the next state fully determined by the current state plus the agent's action on the current state?*

*Stochastic: Something unexpected can always happen.*

*Episodic vs. Sequential: Can the agent make a decision based solely on the current state, without considering past states?*

*Sequential (or Nonepisodic): Data is read continuously. Multiple sequential readings are necessary to determine direction, speed, and magnitude.*

*Static vs. Dynamic: Can the environment change while the agent is deliberating?*

*Dynamic: This is nature! New events can occur at any time, and can effect the classification of events currently being considered.*

*Discrete vs. Continuous: Is the input received in a continuous stream? Is the environment constantly changing? Are the actions that the agent can take distinct/separable from one another?*

*Mostly Discrete: This actually depends upon how often the data is read. Here, the sensors are discrete, the environment is continuously changing, and the actions which the TAR can take are discrete.*