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Artificial Intelligence: Foundations of Computational Agents, 3rd Edition
Solution Manual and Instructor Resources

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Chapter 1

Artificial Intelligence and Agents

Exercise 1.1 For each of the following, give five reasons why:

(a) A dog is more intelligent than a worm.
(b) A human is more intelligent than a dog.
(c) An organization is more intelligent than an individual human.

Based on these, give a definition of what "more intelligent" may mean.

Exercise 1.2 Give as many disciplines as you can whose aim is to study intelligent behavior of some sort. For each discipline, find out what aspect of behavior is investigated and what tools are used to study it. Be as liberal as you can regarding what defines intelligent behavior.

Exercise 1.3 Find out about two applications of AI (not classes of applications, but specific programs). For each application, write at most one typed page describing it. You should try to cover the following questions:

(a) What does the application actually do (e.g., control a spacecraft, diagnose a photocopier, provide intelligent help for computer users)?
(b) What AI technologies does it use (e.g., model-based diagnosis, belief networks, semantic networks, heuristic search, constraint satisfaction)?
(c) How well does it perform? (According to the authors or to an independent review? How does it compare to humans? How do the authors know how well it works?)
(d) Is it an experimental system or a fielded system? (How many users does it have? What expertise do these users require?)
(e) Why is it intelligent? What aspects of it make it an intelligent system?
(f) [optional] What programming language and environment was it written in? What sort of user interface does it have?
(g) References: Where did you get the information about the application? To what books, articles, or webpages should others who want to know about the application refer?

Exercise 1.4 For each of the Winograd schemas in Example 1.2, what knowledge is required to correctly answer the questions? Try to find a "cheap" method to find the answer, such as by comparing the number of results in a Google search for different cases. Try this for six other Winograd schemas of Davis [2015]. Try to construct an example of your own.

Exercise 1.5 Choose four pairs of dimensions that were not compared in Section 1.5.10 on page 35. For each pair, give one commonsense example of where the dimensions interact.

Clicker Questions

Clicker 1.1.
Do you know Python?

A Yes

B No

C Some

What is the output of the Python code:
>>> [$(x+7, x-1)$ for x in range(10) if $x < 3$]

A This is obvious

B I could probably work it out by myself

C I have no idea, I'd probably appreciate a tutorial

Clicker 1.2.

A Yes

B No

C Umm, I'm not sure.... what is an agent again?

- Can a book inspire or explain or enlighten?
- Can a book be an agent?
- Can a paragraph be an agent?
- Can a sentence be an agent?
- Can a word be an agent?
- Can a letter of the alphabet be an agent?

Clicker 1.3.
The *abilities* of an agent are:

A What functions the agent is able to compute

B The set of actions available to the agent

C Whether it can play tennis

D What the agent wants

E What is has learned from experience

Answer: B

Clicker 1.4.
An agent that does not learn does not need:

A Abilities

B Goals/Preferences

C Prior Knowledge

D Observations

E Past experiences

Answer: E

Clicker 1.5.

Prior knowledge is not:

A what is programmed into an agent

B what an agent gets from experience

C what biology has evolved for animals when they are born

D required for both artificial and natural agents

E what psychologists call "nature" in the nature-nurture debate

Answer: B

Clicker 1.6.

What is the role of data in the applications presented:

A It was all that was needed to get the application to work

B It was ignored in the applications presented

C All of the applications required data sets of the size of the set of all of the photos that are posted on the web

D Only expensive proprietary data is useful

E It was used in many of the applications to improve performance

Answer: E

Clicker 1.7.
A domain for transporting parcels betwen cities where the location of each truck and each parcel is known, but trucks can get into accidents is:

A Stochastic and Partially Observable

B Stochastic and Fully Observable

C Deterministic and Fully Observable

D Deterministic and Partially Observable

E None of the above or more than one of the above

Answer: B

Clicker 1.8.
Teaching students concepts to get them to understand is:

A Stochastic and Partially Observable

B Stochastic and Fully Observable

C Deterministic and Fully Observable

D Deterministic and Partially Observable

E None of the above or more than one of the above

Answer: A

Clicker 1.9.
Poker (from each player's point of view) is:

A Stochastic and Partially Observable

B Stochastic and Fully Observable

C Deterministic and Fully Observable

D Deterministic and Partially Observable

E None of the above or more than one of the above

Answer: A

Clicker 1.10.
Sam prefers coffee to tea is:

A achievement goal

B ordinal preference

C cardinal preference

Answer: B

Clicker 1.11.
Sam wants coffee is:

A achievement goal

B ordinal preference

C cardinal preference

Answer: A

Clicker 1.12.
The planning horizon dimension has values static, finite stage, indefinite stage, infinite stage.

The *planning horizon* of an agent is:

A What functions the agent is able to carry out

B The stage of life it is in

C What it heads towards

D How far into the future it considers the consequences of its actions

E Where the agents's sun sets

Answer: D

Clicker 1.13.

A deterministic agent is:

A is determined to get to its goal

B does not know exactly which state it is in

C could predict the next state if it knew its current state and the action to be taken

D no longer has any termites

E knows what state it is in

Answer: C

Clicker 1.14.
An agent that assigns numerical values to a set of features and acts to maximize the sum of the values has:

A cardinal preferences

B goals

C ordinal preferences

D a full-observable environment

E a partially-observable environment

Answer: A

Chapter 2

Agent Architectures and Hierarchical Control

Exercise 2.1 The start of Section 2.2 on page 58 argued that it was impossible to build a representation of a world independently of what the agent will do with it. This exercise lets you evaluate this argument.

Choose a particular world, for example, the things on top of your desk right now.

(i) Get someone to list all of the individuals (things) that exist in this world (or try it yourself as a thought experiment).

(ii) Try to think of twenty individuals that they missed. Make these as different from each other as possible. For example, the ball at the tip of the rightmost ballpoint pen on the desk, the part of the stapler that makes the staples bend, or the third word on page 73 of a particular book on the desk.

(iii) Try to find an individual that cannot be described using your natural language (such as a particular component of the texture of the desk).

(iv) Choose a particular task, such as making the desk tidy, and try to write down all of the individuals in the world at a level of description relevant to this task.

Based on this exercise, discuss the following statements:

(a) What exists in a world is a property of the observer.

(b) We need ways to refer to individuals in ways other than expecting each individual to have a separate name.

(c) Which individuals exist is a property of the task as well as of the world.

(d) To describe the individuals in a domain, you need what is essentially a dictionary of a huge number of words and ways to combine them, and this should be able to be done independently of any particular domain.

Exercise 2.2 Consider the top-level controller of Example 2.6 on page 63.

(a) If the lower level reached the timeout without getting to the target position, what does the agent do?

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