CHAPTER 18

Artificial Intelligence

(Solutions to Odd-Numbered Problems)

Review Questions

1. An interrogator asks a set of questions that are forwarded to a computer and a human being. The interrogator receives two sets of responses: one from the computer and one from the human. After careful examination of the two sets, if the interrogator cannot definitely tell which set has come from the computer, the computer has passed the intelligent test. Some experts think that this is an accurate definition of an intelligent system; some think that the test is not necessarily the definition of an intelligent system.

3. LISP is a programming language that manipulates lists. LISP treats data, as well as a program, as a list,. This means a LISP program can change itself. This feature matches with the idea of an intelligent agent that can learn from the environment and improves its behavior. PROLOG is a language that can build a database of facts and a knowledge base of rules. A program in PROLOG can use logical reasoning to answer questions that can be inferred from the knowledge base.

5. Propositional logic is a language made of a set of sentences that can be used to do logical reasoning about the world. In propositional logic, a symbol that represents a sentence is atomic; it cannot be broken to find some information about its components. To do so, we need predicate logic, the logic that defines the relation between the parts in a proposition.

7. A ruled-based system represents knowledge using a set of rules that can be used to deduce some new facts from already-known facts. The semantic network is a graphical representation of entities and their relationships.

9. The five stages of image processing are edge detection, segmentation, finding depth, finding orientation, and object recognition.

11. Neural networks try to simulate the learning process of the human brain using a networks of artificial neurons.

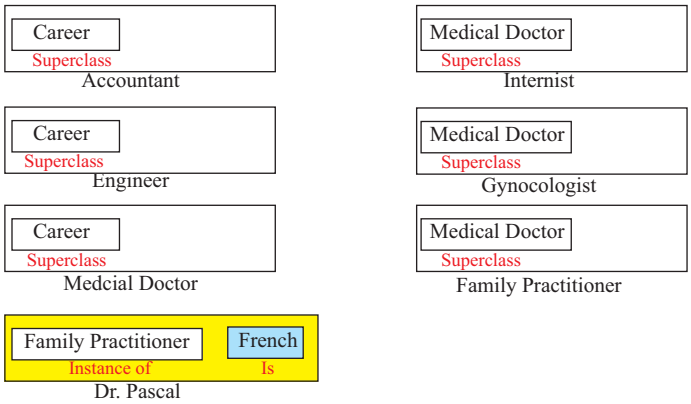
Multiple-Choice Questions

13. d 15. c 17. d 19. b 21. c 23. a
25. c

Exercises

27. The set of frames are shown in Figure S18.27.

Figure S18.27 *Exercise 27*



29.

a. It is not hot.
b. It is warm or it is hot.
c. It is warm and hot.
d. It is warm but it is not hot.
e. It is not true that it is warm and hot.
f. If it is warm, then it is hot.
g. If it is not cold, then it is warm.
h. It is not true that if is not warm, then it is hot.
i. It is hot if it is not warm.
j. It is not cold and hot, or it is cold and not hot.

31.

a. $\exists x[Cat\ (x) \rightarrow Has\ (\text{John}, x)]$
b. $\forall x[Cat\ (x) \rightarrow Loves\ (\text{John}, x)]$
c. $Loves\ (\text{John}, \text{Anne})$
d. $\exists x[Dog\ (x) \wedge Loves\ (\text{Anne}, x)]$
e. $\exists x[\neg\ Cat\ (x) \wedge Loves\ (\text{John}, x)]$

f. $\exists x[\ Cat\ (x) \wedge \neg\ Loves\ (\text{Anne}, x)]$

g. $\exists x\{[\ Cat\ (x) \wedge \neg\ Loves\ (\text{John}, x)] \rightarrow Loves\ (\text{Anne}, x)\}$

h. $\exists x\{[\ Cat\ (x) \wedge \neg\ Loves\ (\text{John}, x)] \leftrightarrow Loves\ (\text{Anne}, x)\}$

i.

33.

a. $\neg\ Identical\ (\text{John, Anne})$

b. $\exists x[\text{John}\ (x)]$

c. $\neg\exists x[\text{Anne}\ (x)]$

d. $\exists x$

e. $\neg\exists x$

f. $\exists x \exists y[\neg\ Identical\ (x, y)]$

35. The truth table is shown below. The argument $\{P \vee Q, P\} \vdash Q$ is not valid:

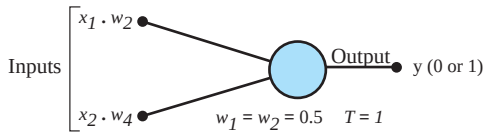
P	Q	P ∨ Q	P	Q	
F	F	F	F	**F**	
F	T	T	F	**T**	
T	F	T	T	**F**	**Counterexample**
T	T	T	T	**T**	**OK**
		Premise	Premise	Conclusion	

37. The truth table is shown below. The argument $\{P \rightarrow Q, Q \rightarrow R\} \vdash (P \rightarrow R)$ is not valid

P	Q	R	P → Q	Q → R	P → R	
F	F	F	T	T	**T**	**OK**
F	F	T	T	T	**T**	**OK**
F	T	F	T	F	**T**	**Counterexample**
F	T	T	T	T	**T**	**OK**
T	F	F	F	T	**F**	
T	F	T	F	T	**T**	
T	T	F	T	F	**F**	
T	T	T	T	T	**T**	**OK**
			Premise	Premise	Conclusion	

39. The design of neural network, with weights $w_1 = w_2 = 0.5$ and the threshold of $T = 1$, is shown in Figure S18.39.

Figure S18.39 *Exercise 39*

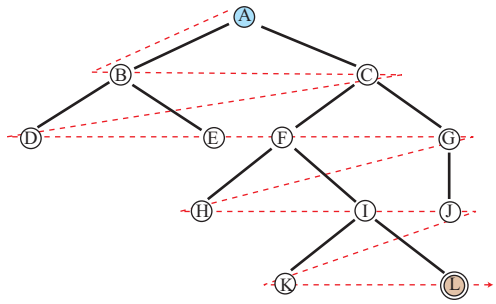


The truth table for this neural network is shown below. It is the same as the truth table for an AND gate.

Inputs		$S = x_1 \cdot w_1 + x_2 \cdot w_2$	Compare S with T	Output
0	0	0	$S < T$	0
0	1	0.5	$S < T$	0
1	0	0.5	$S < T$	0
1	1	1	$S = T$	1

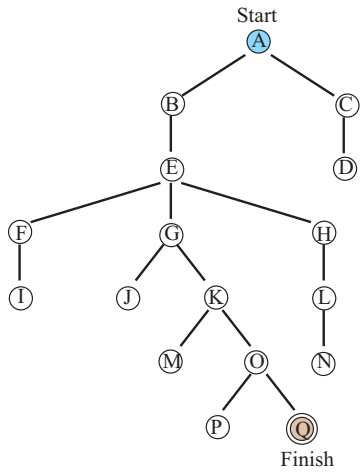
41. Figure S18.41 shows the breadth-first search for the tree diagram.

Figure S18.41 *Exercise 41*



43. Figure S18.43 shows the tree diagram for the maze.

Figure S18.43 *Exercise 43*



45. Figure S18.45 shows the depth-first search for Exercise 43.

Figure S18.45 *Exercise 45*