高级人工智能 10.26 exercise

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2021 年 10 月 26 日

1 Exercise 2.

Edgar Abercrombie was an anthropologist who was particularly interested in the logic and sociology of lying and truth-telling. One day he decided to visit the Island of Knights and Knaves,in which those called knights always tell the truth and knaves always lie. Furthermore, each inhabitant is either a knight or a knave.

Next, Abercrombie met just two inhabitants, A and B. A made the following statement: "Both of us are knaves."

What is A and what is B?

1.1 Solution

Knowledge representation:

- The i-th person is a knight: A_i
- The i-th person is a knave: $\neg A_i$
- The i-th person said P: $A_i \Leftrightarrow P$

Knowledge base:

- $A_1 \Leftrightarrow (\neg A_1 \wedge \neg A_2)$

then, we have:

A_1	A_2	$A_1 \Leftrightarrow (\neg A_1 \wedge \neg A_2)$
0	0	0
0	**1**	**1**
1	0	0
1	1	0

therefore,

$$KB \vDash (\neg A_1, A_2)$$

so A is a knave and B is a knight.

2 Exercise 3.

Edgar Abercrombie was an anthropologist who was particularly interested in the logic and sociology of lying and truth-telling. One day he decided to visit the Island of Knights and Knaves,in which those called knights always tell the truth and knaves always lie. Furthermore, each inhabitant is either a knight or a knave.

According to another version of the story, Abercrombie didn't ask A whether he was a knight or a knave (because he would have known in advance what answer he would get), but instead asked A how many of the three were knaves. Again A answered indistinctly, so Abercrombie asked B what A had said. B then said that A had said that exactly two of them were knaves. Then, as before, C claimed that B was lying.

Is it now possible to determine whether C is a knight or a knave?

2.1 Solution

Knowledge representation:

- The i-th person is a knight: A_i
- The i-th person is a knave: $\neg A_i$
- The i-th person said P: $A_i \Leftrightarrow P$

Knowledge base:

- $A_2 \Leftrightarrow \{A_1 \Leftrightarrow [(\neg A_1 \wedge \neg A_2 \wedge A_3) \vee (\neg A_1 \wedge A_2 \wedge \neg A_3) \vee (\neg A_1 \wedge \neg A_2 \wedge A_3)]\}$
- $A_3 \Leftrightarrow \neg A_2$

then, we have:

A_1	A_2	A_3	$A_3 \Leftrightarrow \neg A_2$	$A_2 \Leftrightarrow \{A_1 \Leftrightarrow [(\neg A_1 \wedge \neg A_2 \wedge A_3) \vee (\neg A_1 \wedge A_2 \wedge \neg A_3) \vee (\neg A_1 \wedge \neg A_2 \wedge A_3)]\}$
0	0	0	0	0
0	**0**	**1**	**1**	**1**
0	1	0	1	0
0	1	1	0	1
1	0	0	0	0
1	**0**	**1**	**1**	**1**
1	1	0	1	0
1	1	1	0	0

therefore,

$$KB \models A_3$$

so C is a knight.