

Programing Assignment #6

CSCE 625 - Artificial Intelligence

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1. Knowledge base for Sammy's Sport Shop

1.1. Per color appears at least once and at most once.

Table 1 clauses for each color appears at least once and at most once

$C1W \ C2W \ C3W$ $-C1W \ -C2W$ $-C1W \ -C3W$ $-C2W \ -C3W$	$C1Y \ C2Y \ C3Y$ $-C1Y \ -C2Y$ $-C1Y \ -C3Y$ $-C2Y \ -C3Y$	$C1B \ C2B \ C3B$ $-C1B \ -C2B$ $-C1B \ -C3B$ $-C2B \ -C3B$
White	Yellow	Both

1.2. The labels are definitely wrong.

$L1W \rightarrow -C1W$ will be transformed to $-L1W \ -C1W$.

Table 2 clauses for each box with wrong label

$-L1W \ -C1W$ $-L1Y \ -C1Y$ $-L1B \ -C1B$	$-L2W \ -C2W$ $-L2Y \ -C2Y$ $-L2B \ -C2B$	$-L3W \ -C3W$ $-L3Y \ -C3Y$ $-L3B \ -C3B$
Box 1	Box 2	Box 3

1.3. The observed color implies something about what the box contains.

$O1Y \leftrightarrow (C1Y \vee C1B)$ will be transformed to $(-O1Y \ C1Y \ C1B) \vee (O1Y \ -C1Y) \vee (O1Y \ -C1B)$.

Table 3 clauses for each box with color observed

$-O1Y \ C1Y \ C1B$ $O1Y \ -C1Y$ $O1Y \ -C1B$ $-O1W \ C1W \ C1B$ $O1W \ -C1W$ $O1W \ -C1B$	$-O2Y \ C2Y \ C2B$ $O2Y \ -C2Y$ $O2Y \ -C2B$ $-O2W \ C2W \ C2B$ $O2W \ -C2W$ $O2W \ -C2B$	$-O3Y \ C3Y \ C3B$ $O3Y \ -C3Y$ $O3Y \ -C3B$ $-O3W \ C3W \ C3B$ $O3W \ -C3W$ $O3W \ -C3B$
Box 1	Box 2	Box 3

1.4. Facts.

Table 4 clauses for facts about labels and colors observed

<i>L1W</i>	<i>O1Y</i>
<i>L2Y</i>	<i>O2W</i>
<i>L3B</i>	<i>O3Y</i>
Labels	Colors observed

1.5. Query and negative query.

The query "box 2 must contain white balls" is *C2W*. So the negative query is *-C2W*.

2. Run and compile the code

2.1.

The file I turned in are "Prover.java", "KB.txt", and "transcript_former.txt".

2.2.

Compile with command "javac Prover.java", then run with command "java Prover".

2.3.

Enter the file name of knowledge base, "KB.txt". It will generate a file named "transcript.txt", which contains the transcript.

```
C:\Windows\System32>cd C:\Users\001\Desktop\AI_hw6
C:\Users\001\Desktop\AI_hw6>javac Prover.java
C:\Users\001\Desktop\AI_hw6>java Prover
Enter the file name of knowledge base.KB.txt
success - empty clause!
```

Figure 1

3. Performance

When proving the knowledge base does entail a query, Resolution Refutation proof procedure can quickly complete the proof. However, when proving the knowledge base does not entail a query, this method must exhaust all the resolvable pairs in the queue. As a result, if the input is not small, it might take quite a while to complete the proof. Still, if the input is too large, out of memory might happen.

----- There are appendixes in the next pages. -----

Appendix A: Transcript

initial clauses

0: $(C1W \vee C2W \vee C3W)$

1: $(\neg C1W \vee \neg C2W)$

2: $(\neg C1W \vee \neg C3W)$

3: $(\neg C2W \vee \neg C3W)$

4: $(C1Y \vee C2Y \vee C3Y)$

...

...

40: $(L2Y)$

41: $(L3B)$

42: $(O1Y)$

43: $(O2W)$

44: $(O3Y)$

45: $(\neg C2W)$

[Qsize=112] resolving 0 and 45 on C2W: $(C1W \vee C2W \vee C3W)$ and $(\neg C2W) \rightarrow (C1W \vee C3W)$

46: $(C1W \vee C3W)$

[Qsize=119] resolving 12 and 39 on -L1W: $(\neg C1W \vee \neg L1W)$ and $(L1W) \rightarrow (\neg C1W)$

47: $(\neg C1W)$

[Qsize=121] resolving 16 and 40 on -L2Y: $(\neg C2Y \vee \neg L2Y)$ and $(L2Y) \rightarrow (\neg C2Y)$

48: $(\neg C2Y)$

[Qsize=122] resolving 20 and 41 on -L3B: $(\neg C3B \vee \neg L3B)$ and $(L3B) \rightarrow (\neg C3B)$

49: $(\neg C3B)$

...

...

[Qsize=215] resolving 49 and 66 on C3B: $(\neg C3B)$ and $(\neg O3Y \vee C3B) \rightarrow (\neg O3Y)$

70: $(\neg O3Y)$

[Qsize=217] resolving 49 and 67 on C3B: $(\neg C3B)$ and $(C3B \vee C3Y) \rightarrow (C3Y)$

71: $(C3Y)$

[Qsize=221] resolving 64 and 67 on C3Y: $(\neg C3Y)$ and $(C3B \vee C3Y) \rightarrow (C3B)$

[Qsize=220] resolving 10 and 69 on C3B: $(\neg C1B \vee \neg C3B)$ and $(C3B) \rightarrow (\neg C1B)$

[Qsize=219] resolving 11 and 69 on C3B: $(\neg C2B \vee \neg C3B)$ and $(C3B) \rightarrow (\neg C2B)$

72: $(\neg C2B)$

[Qsize=227] resolving 20 and 69 on C3B: $(\neg C3B \vee \neg L3B)$ and $(C3B) \rightarrow (\neg L3B)$

73: $(\neg L3B)$

[Qsize=227] resolving 35 and 69 on C3B: $(\neg C3B \vee O3Y)$ and $(C3B) \rightarrow (O3Y)$

[Qsize=226] resolving 38 and 69 on C3B: $(\neg C3B \vee O3W)$ and $(C3B) \rightarrow (O3W)$

74: (O3W)

[Qsize=226] resolving 49 and 69 on C3B: $(\neg C3B)$ and $(C3B) \rightarrow ()$

75: ()

success - empty clause!

proof trace:

75: () [49,69]

49: $(\neg C3B)$ [20,41]

20: $(\neg C3B \vee \neg L3B)$ input

41: $(L3B)$ input

69: $(C3B)$ [44,66]

44: $(O3Y)$ input

66: $(\neg O3Y \vee C3B)$ [33,64]

33: $(\neg O3Y \vee C3B \vee C3Y)$ input

64: $(\neg C3Y)$ [6,62]

6: $(\neg C1Y \vee \neg C3Y)$ input

62: $(C1Y)$ [51,55]

51: $(C1B \vee C1Y)$ [21,42]

21: $(\neg O1Y \vee C1B \vee C1Y)$ input

42: $(O1Y)$ input

55: $(\neg C1B)$ [9,54]

9: $(\neg C1B \vee \neg C2B)$ input

54: $(C2B)$ [45,52]

45: $(\neg C2W)$ input

52: $(C2B \vee C2W)$ [30,43]

30: $(\neg O2W \vee C2B \vee C2W)$ input

43: $(O2W)$ input