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Is Dracula still alive?

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The First Five Cases [1]

Despite what Bram Stoker has told us, our protagonist had his own reasons to doubt that Count Dracula was ever really destroyed. So, he did the only logical thing, and went to Transylvania to investigate and decide the truth for himself.

At the time he was in Transylvania, about half of the inhabitants were human and half were vampires. The humans and vampires were indistinguishable in their outward appearance, but the humans always tell the truth and the vampires always lie. Moreover, half of the inhabitants in Transylvania were also insane. Thus the inhabitants are of four types: sane humans, insane humans, sane vampires and insane vampires. Whatever a sane human or an insane vampire says is true and whatever a sane vampire or an insane human says is false. Who were vampires and who were humans from the following experiences of our protagonist?

167) I once met a Transylvanian who said, "I am human or I am sane". Exactly what type was he?

168) Another inhabitant said, "I am not a sane human". What type was he?

169) Another inhabitant said, "I am an insane human". Is he of the same type as the last inhabitant?

170) I once met an inhabitant and asked him, "Are you an insane vampire?" He answered "Yes" or "No", and I knew what he was. What was he?

171) I once met a Transylvanian who said, "I am a vampire". Can it be inferred whether he is human or a vampire? Can it be inferred whether he is sane?

Who were vampires and who were humans?

Solutions

The solutions are as follow:

167) Let's suppose that the statement is false. Then, he is neither human or sane, so he must be an insane vampire. But insane vampires can only make true statements, which results in a contradiction. Therefore, if only sane humans and insane vampires can make true statements, and he cannot be an insane vampire, he must be a sane human.

168) Again, we suppose that the statement is false, so he must be an insane human or a sane vampire, but both of these types cannot tell the truth and we have a contradiction. Also, he can't be a sane human because then he wouldn't be telling the truth. Therefore, he must be an insane vampire.

169) Following the same logic as before, we can quickly deduce that he can't be a sane human or an insane vampire because they can only tell the truth. Choosing between the remaining two types is easy because they can only tell lies. If the insane human were to say that, he would be telling the truth, so we can cross him out. So, the only remaining Transylvanian type is the sane vampire.

170) In this case, the inhabitant did not give a straight answer to the question. Applying the same method as before, a sane human would answer "No" and any other of the three types would answer "Yes". So, one correct possible outcome is that he answers yes and coincidentally he is an insane vampire. On the other hand, if we don't count on luck we can tell for certain which type of inhabitant he is only if he answers "No", him being a sane human.

171) It cannot be inferred whether he is human or a vampire, but it does follow that he is insane. A sane human would not say that he is a vampire and a sane vampire would know that he is a vampire and would lie and say he is a human. On the other hand, an insane human would believe, and hence would say he is a vampire, and an insane vampire would believe he was human and would then say he is a vampire. So, anyone who says he is a human is sane, and anyone who says he is a vampire is insane.

Human or Vampire	human	human	vampire	vampire
Sane or Insane	sane	insane	sane	insane
Truth or Lie	T	L	L	T

Mace4 Solutions

Listing 1: 167

```
1 formulas(assumptions).
2 %human/vampire
3 % h1 : e om
4 %¬h1 : e vampir
5
6 %sane/insane
7 % s1 : nu e ne bun
8 %¬s1 : e ne bun
9
10 %dialog
11 %d1 = ce spune
12 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
13
14 %i am a human or i am sane
15 d1 <-> h1 | s1.
16
17 %aici luam toate cazurile posibile de vampirism si ne bunie in urmatorul fel:
18 %Sane Human => True
19 %Insane Human => False
20 %Sane Vampire => False
21 %Insane Vampire => True
22
23 (¬h1 & ¬s1) -> d1.
24 (¬h1 & s1) -> ¬d1.
25 ( h1 & ¬s1) -> ¬d1.
26 ( h1 & s1) -> d1.
27
28 end_of_list.
```

```
hulea@hulea-VirtualBox:~/Desktop$ mace4 -c -n 2 -m -1 -f 167.in | interpformat
    === Mace4 starting on domain size 2. ===
    ----- process 6032 exit (all_models) -----
    interpretation( 2, [number = 1,seconds = 0], [
        relation(d1, [1]),
        relation(h1, [1]),
        relation(s1, [1])]).
```

Listing 2: 168

```
1 formulas(assumptions).
2 %human/vampire
3 % h1 : e om
4 %¬h1 : e vampir
5
6 %sane/insane
7 % s1 : nu e ne bun
8 %¬s1 : e ne bun
9
10 %dialog
11 %d1 = ce spune
12 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
13
14 %i am not a sane human
15 d1 <-> -(s1 & h1).
```

```

16
17 %aici luam toate cazurile posibile de vampirism si ne bunie in urmatorul fel:
18 %Sane Human => True
19 %Insane Human => False
20 %Sane Vampire => False
21 %Insane Vampire => True
22
23 ( $\neg$ h1 &  $\neg$ s1)  $\rightarrow$  d1.
24 ( $\neg$ h1 & s1)  $\rightarrow$   $\neg$ d1.
25 ( h1 &  $\neg$ s1)  $\rightarrow$   $\neg$ d1.
26 ( h1 & s1)  $\rightarrow$  d1.
27
28 end_of_list .

```

```

hulea@hulea-VirtualBox:~/Desktop$ mace4 -c -n 2 -m -1 -f 168.in | interformat
==== Mace4 starting on domain size 2. ====
----- process 6034 exit (all_models) -----
interpretation( 2, [number = 1,seconds = 0], [
    relation(d1, [1]),
    relation(h1, [0]),
    relation(s1, [0])]).

```

Listing 3: 169

```

1 formulas(assumptions).
2 %human/vampire
3 % h1 : e om
4 % $\neg$ h1 : e vampir
5
6 %sane/insane
7 % s1 : nu e ne bun
8 % $\neg$ s1 : e ne bun
9
10 %dialog
11 %d1 = ce spune
12 %%%%%%%%%%%%%%
13
14 %i am an insane human
15 d1  $\leftrightarrow$  h1 &  $\neg$ s1.
16
17 %aici luam toate cazurile posibile de vampirism si ne bunie in urmatorul fel:
18 %Sane Human => True
19 %Insane Human => False
20 %Sane Vampire => False
21 %Insane Vampire => True
22
23 ( $\neg$ h1 &  $\neg$ s1)  $\rightarrow$  d1.
24 ( $\neg$ h1 & s1)  $\rightarrow$   $\neg$ d1.
25 ( h1 &  $\neg$ s1)  $\rightarrow$   $\neg$ d1.
26 ( h1 & s1)  $\rightarrow$  d1.
27
28 end_of_list .

```

```

hulea@hulea-VirtualBox:~/Desktop$ mace4 -c -n 2 -m -1 -f 169.in | interformat
==== Mace4 starting on domain size 2. ====
----- process 6036 exit (all_models) -----
interpretation( 2, [number = 1,seconds = 0], [
    relation(d1, [0]),
    relation(h1, [0]),
    relation(s1, [1])]).
```

Listing 4: 170

```

1 formulas(assumptions).
2 %human/vampire
3 % h1 : e om
4 %¬h1 : e vampir
5
6 %sane/insane
7 % s1 : nu e nebun
8 %¬s1 : e nebun
9
10 %dialog
11 %d1 = ce spune
12 %%%%%%%%%%%%%%
13
14 %i am or i am not an insane vampire
15 d1 <-> (¬h1 & ¬s1) | (¬h1 & s1).
16
17 %aici luam toate cazurile posibile de vampirism si nebunie in urmatorul fel:
18 %Sane Human => True
19 %Insane Human => False
20 %Sane Vampire => False
21 %Insane Vampire => True
22
23 (¬h1 & ¬s1) -> d1.
24 (¬h1 & s1) -> ¬d1.
25 ( h1 & ¬s1) -> ¬d1.
26 ( h1 & s1) -> d1.
27
28 end_of_list.
```

```

hulea@hulea-VirtualBox:~/Desktop$ mace4 -c -n 2 -m -1 -f 170.in | interformat
==== Mace4 starting on domain size 2. ====
----- process 6038 exit (all_models) -----
interpretation( 2, [number = 1,seconds = 0], [
    relation(d1, [1]),
    relation(h1, [0]),
    relation(s1, [0])]).
interpretation( 2, [number = 2,seconds = 0], [
    relation(d1, [1]),
    relation(h1, [1]),
    relation(s1, [1])]).
```

Listing 5: 171

```

1 formulas( assumptions ).  

2 %human/vampire  

3 % h1 : e om  

4 %¬h1 : e vampir  

5  

6 %sane/insane  

7 % s1 : nu e nebun  

8 %¬s1 : e nebun  

9  

10 %dialog  

11 %d1 = ce spune  

12 %%%%%%  

13  

14 %i am a vampire  

15 d1 <-> ¬h1.  

16  

17 %aici luam toate cazurile posibile de vampirism si nebunie in urmatorul fel:  

18 %Sane Human => True  

19 %Insane Human => False  

20 %Sane Vampire => False  

21 %Insane Vampire => True  

22  

23 (¬h1 & ¬s1) -> d1.  

24 (¬h1 & s1) -> ¬d1.  

25 ( h1 & ¬s1) -> ¬d1.  

26 ( h1 & s1) -> d1.  

27  

28 end_of_list .

```

```

hulea@hulea-VirtualBox:~/Desktop$ mace4 -c -n 2 -m -1 -f 171.in | interpretformat
    === Mace4 starting on domain size 2. ===
    ----- process 6040 exit (all_models) -----
interpretation( 2, [number = 1,seconds = 0], [
    relation(d1, [0]),
    relation(h1, [1]),
    relation(s1, [0])]).
interpretation( 2, [number = 2,seconds = 0], [
    relation(d1, [1]),
    relation(h1, [0]),
    relation(s1, [0])]).

```

Bibliography

- [1] Raymond M Smullyan. *What is the name of this book? The riddle of Dracula and other logical puzzles.* Library of Congress Cataloging in Publication Data, 1978.

Intelligent Systems Group

