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ASSIGNMENT 5

The atomic sentence is about ownership of each item. For example, “Robot A owns Item X”. Each atomic sentence is identified by four letters. The first two capital letters signify the name of the robot masters, and the last two small letters signify the name of the item. The atomic sentences are as follows. We have a total of eight atomic sentences.

- $SNrj$  – Snakeman owns Rushjet.
- $SNrm$  – Snakeman owns Rushmarine.
- $NErj$  – Needleman owns Rushjet.
- $NErm$  – Needleman owns Rushmarine.
- $GErj$  – Geminiman owns Rushjet.
- $GErm$  – Geminiman owns Rushmarine.
- $SHrj$  – Shadowman owns Rushjet.
- $SHrm$  – Shadowman owns Rushmarine.

Next, we encode Dr. Light’s notes into the propositional logic of using the atomic sentences.

- One of Snakeman, Needleman and Geminiman has the Rushjet.

$$SNrj \vee NErj \vee GErj$$

- One of Snakeman and Shadowman has the Rushmarine.

$$SNrm \vee SHrm$$

- There is only one Rushjet.

$$\begin{aligned} SNrj &\Rightarrow (\neg NErj \wedge \neg GErj \wedge \neg SHrj) \\ \neg SNrj &\vee (\neg NErj \wedge \neg GErj \wedge \neg SHrj) \\ (\neg SNrj \vee \neg NErj) &\wedge (\neg SNrj \vee \neg GErj) \wedge (\neg SNrj \vee \neg SHrj) \\ NErj &\Rightarrow (\neg SNrj \wedge \neg GErj \wedge \neg SHrj) \\ \neg NErj &\vee (\neg SNrj \wedge \neg GErj \wedge \neg SHrj) \\ (\neg NErj \vee \neg SNrj) &\wedge (\neg NErj \vee \neg GErj) \wedge (\neg NErj \vee \neg SHrj) \\ GErj &\Rightarrow (\neg SNrj \wedge \neg NErj \wedge \neg SHrj) \\ \neg GErj &\vee (\neg SNrj \wedge \neg NErj \wedge \neg SHrj) \\ (\neg GErj \vee \neg SNrj) &\wedge (\neg GErj \vee \neg NErj) \wedge (\neg GErj \vee \neg SHrj) \\ SHrj &\Rightarrow (\neg SNrj \wedge \neg NErj \wedge \neg GErj) \\ \neg SHrj &\vee (\neg SNrj \wedge \neg NErj \wedge \neg GErj) \\ (\neg SHrj \vee \neg SNrj) &\wedge (\neg SHrj \vee \neg NErj) \wedge (\neg SHrj \vee \neg GErj) \end{aligned}$$

- Similarly, there is only one Rushmarine. The same clauses are derived except we replace  $rj$  with  $rm$ .

$$\begin{aligned}
& (\neg SNrm \vee \neg Nerm) \wedge (\neg SNrm \vee \neg Germ) \wedge (\neg SNrm \vee \neg SHrm) \\
& (\neg Nerm \vee \neg SNrm) \wedge (\neg Nerm \vee \neg Germ) \wedge (\neg Nerm \vee \neg SHrm) \\
& (\neg Germ \vee \neg SNrm) \wedge (\neg Germ \vee \neg Nerm) \wedge (\neg Germ \vee \neg SHrm) \\
& (\neg SHrm \vee \neg SNrm) \wedge (\neg SHrm \vee \neg Nerm) \wedge (\neg SHrm \vee \neg Germ)
\end{aligned}$$

- The same robot doesn't have both items.

$$\begin{aligned}
& SNrj \Rightarrow \neg SNrm \\
& \neg SNrj \vee \neg SNrm \\
& NErj \Rightarrow \neg Nerm \\
& \neg NErj \vee \neg Nerm \\
& GERj \Rightarrow \neg Germ \\
& \neg GERj \vee \neg Germ \\
& SHrj \Rightarrow \neg SHrm \\
& \neg SHrj \vee \neg SHrm
\end{aligned}$$

- If Geminiman has the Rushjet, then Shadowman does not have the Rushmarine.

$$\begin{aligned}
& GERj \Rightarrow \neg SHrm \\
& \neg GERj \vee \neg SHrm
\end{aligned}$$

- If Shadowman has the Rushmarine, then Snakeman does not have the Rushjet.

$$\begin{aligned}
& SHrm \Rightarrow \neg SNrj \\
& \neg SHrm \vee \neg SNrj
\end{aligned}$$

- If Snakeman has the Rushmarine, then Geminiman does not have the Rushjet.

$$\begin{aligned}
& SNrm \Rightarrow \neg GMrj \\
& \neg SNrm \vee \neg GMrj
\end{aligned}$$

Using the converted statements above, the knowledge base is as follows which are numbered for future reference.

1.  $SNrj \vee NErj \vee GERj$
2.  $SNrm \vee SHrm$
3.  $\neg SNrj \vee \neg NErj$
4.  $\neg SNrj \vee \neg GERj$
5.  $\neg SNrj \vee \neg SHrj$
6.  $\neg NErj \vee \neg SNrj$
7.  $\neg NErj \vee \neg GERj$
8.  $\neg NErj \vee \neg SHrj$
9.  $\neg GERj \vee \neg SNrj$
10.  $\neg GERj \vee \neg NErj$
11.  $\neg GERj \vee \neg SHrj$
12.  $\neg SHrj \vee \neg SNrj$
13.  $\neg SHrj \vee \neg NErj$
14.  $\neg SHrj \vee \neg GERj$
15.  $\neg SNrm \vee \neg Nerm$
16.  $\neg SNrm \vee \neg Germ$
17.  $\neg SNrm \vee \neg SHrm$
18.  $\neg Nerm \vee \neg SNrm$
19.  $\neg Nerm \vee \neg Germ$
20.  $\neg Nerm \vee \neg SHrm$
21.  $\neg Germ \vee \neg SNrm$

22.  $\neg GEr m \vee \neg NEr m$
23.  $\neg GEr m \vee \neg SHr m$
24.  $\neg SHr m \vee \neg SNr m$
25.  $\neg SHr m \vee \neg NEr m$
26.  $\neg SHr m \vee \neg GEr m$
27.  $\neg SNr j \vee \neg SNr m$
28.  $\neg SNr j \vee \neg SNr m$
29.  $\neg NEr j \vee \neg NEr m$
30.  $\neg GEr j \vee \neg GEr m$
31.  $\neg SHr j \vee \neg SHr m$
32.  $\neg GEr j \vee \neg SHr m$
33.  $\neg SHr m \vee \neg SNr j$
34.  $\neg SNr m \vee \neg GMr j$

#### ***Who has the Rushjet?***

Based on the knowledge base, there are multiple possibilities of the owner of the Rushjet. The owner of the Rushjet can be singled out if additional logical queries about the Rushjet and Rushmarine are specified.

#### ***Who has the Rushmarine?***

Just like the Rushjet, the owner of the Rushmarine can either be Snakeman or Shadowman. A logical query about the relation between Snakeman and Shadowman could let us determine the exact owner.