Welcome

LTL

This survey asks about the meaning of LTL formulas and their translation to and from English.

There are three parts:

1. Match traces and formulas (8 questions)
2. Translate formulas to English (2 questions)
3. Translate English to formulas (2 questions)

The questions ask about the state of a robot-driven locomotive (RoboLoc) over time. The RoboLoc has three components, each of which can be ON or OFF at any point: the engine, the door, and the headlight. In the image below, the engine is on, the door is open, and the headlight is off:
(Engine \ DoorOpen \ not Light)

The RoboLoc is a discrete system, not a hybrid system.

Traces true–false

Part 1 of 3: Match traces and formulas
The following questions ask whether a trace of the RoboLoc satisfies an LTL formula.

A trace is an infinite sequence of states. We represent traces as five states of the RoboLoc in which the final state repeats forever.

We first give two Examples to illustrate the questions and the style of answers that we are expecting.
Example Question: Is the formula
\[ G(\text{Engine} \lor \text{Light}) \]
satisfied by this trace?

Example Answer: Yes, because either the engine (smoke) or the headlight is on in each state.

Does the example make sense to you?*

- Yes
- No (please explain)

Example Question: Is the formula
\[ F(\text{Engine} \land \text{DoorOpen}) \]
satisfied this trace?
Example Answer: No, because there is no state in which the engine is on and the door is open.

Does the example make sense to you?*

- Yes
- No (please explain)

The actual task begins now.

Q. Is the formula

\[ \text{Engine} \]

satisfied by this trace?*
(Optional) Feel free to explain your reasoning

Q. Is the formula Engine satisfied by this trace?*

Yes
No
Q. Is the formula \( \text{not } G(\text{DoorOpen}) \) satisfied by this trace?*

(Q) Feel free to explain your reasoning

- Yes
- No

(Optional) Feel free to explain your reasoning
Q. Is the formula

\[ X(X(X(\text{Engine}))) \]

satisfied by this trace?*

- Yes
- No

(Optional) Feel free to explain your reasoning
Q. Is the formula
   \[ F(G(\text{Engine})) \]
   satisfied by this trace?*

   \( \bigcirc \) Yes
   \( \bigcirc \) No
   
   (Optional) Feel free to explain your reasoning
Q. Is the formula $\text{Engine U DoorOpen}$ satisfied by this trace?*

- Yes
- No

(Optional) Feel free to explain your reasoning
Q. Is the formula Engine U Light satisfied by this trace?*

- [ ] Yes
- [ ] No

(Optional) Feel free to explain your reasoning
Q. Is the formula
\[ F(\text{Engine}) \land F(\text{DoorOpen}) \]
satisfied by this trace?*

Yes
No

(Optional) Feel free to explain your reasoning
Q. Is the formula
   \[ G(\text{Engine} \implies \text{Light}) \]
   satisfied by this trace?*

- Yes
- No

(Optional) Feel free to explain your reasoning
LTL to English

Part 2 of 3: Translate formulas to English
Translate the following formulas to English sentences.

If you have do not know how to translate a formula, write "I don't know" below.

We first show one Example to illustrate the questions and the style of answers that we are expecting.

Example Question:
\[ G(\text{Engine} \implies X(\neg \text{DoorOpen})) \]

Example Answer: Whenever the engine is on, the door is closed in the next state.
Does the example make sense to you?*  

☐ Yes  
☐ No (please explain)

The actual task begins now.

\[X(X(F(X(\text{Engine}))))\]

(Optional) Feel free to explain your reasoning
F(Engine) ==> G(Light)

(Optional) Feel free to explain your reasoning

English to LTL
Part 3 of 3: Translate English to formulas

Translate the following English sentences to LTL formulas.

- If you do not know how to express an idea in LTL, write "I don't know" below.
- If you believe LTL cannot express a specification, write "inexpressible" and please explain.

As a reminder, here are the LTL connectives and RoboLoc variables:

- G  F  X  U
- \( / \ \backslash / \) ==> not
- Engine DoorOpen Light

We first show one Example to illustrate the questions and the style of answers that we are expecting.

Example Question: The door is never closed.

Example Answer: 
\[ G(\text{DoorOpen}) \]
Does the example make sense to you?*

- [ ] Yes
- [ ] No (please explain)

The actual task begins now.

Whenever the engine is on, it is off in the next state and on again in the state after that.

(Optional) Feel free to explain your reasoning
The engine cannot stay on for three states in a row.

(Optional) Feel free to explain your reasoning

Block 4
This is the final page. Click the right arrow (→) below to submit.