Weekly Challenge 06: Logical Inference

CS/MATH 113 Discrete Mathematics

Spring 2024

1. Sacred Secrets

Legend has it that one of the TAs from a previous offering of CS/MATH 113 prepared a manual, "Sacred Secrets: How to Earn an A+ and Stay Sane". However their own sanity is sadly no longer intact. The LaTeX source and the repository got deleted and all that exists about the location of the only printed copy are the following instructions.

1. There is a hint at Learn Courtyard or at the Gym.
2. If your TA is sitting in Ehsas or they are absent, then there is a hint at Learn Courtyard.
3. If your TA is not sitting in Ehsaas, then there is a hint at the Gym.
4. If there are people in Learn Courtyard, then there is no hint at Learn Courtyard.
5. If there is a hint at Learn Courtyard, then the manual is at Zen Garden.
6. If there is hint at the Gym, then the manual is at Earth Courtyard.
7. If your TA is absent, then the manual is at Fire Courtyard.

You notice that there are people in Learn Courtyard. Show how you can infer the location of the manual.

Solution:

	step	reason
8)	There are people in Learn Courtyard	
9)	There is no hint at Learn Courtyard	Modus ponens (4)(8)
10)	TA is not sitting in ehsas and they are not absent	Modus tollens (2)(9)
11)	TA is not sitting in ehsas	simplification (10)
12)	There is a hint at the gym	Modus ponens (11)(3)
13)	The manual is at Earth Courtyard	Modus ponens (12)(6)

Therefore the location of the manual is Earth courtyard found by a series of inferences

2. The Other Side

You are given four cards each of which has a number on one side and a letter on another. You place them on a table in front of you and the four cards read: `A 5 2 J`. Which cards would you turn over in order to test the following rule? Explain your choice.

Cards with 5 on one side have J on the other side.

Solution: Since we are given that 5 on one side should have J on the other, it is possible that there is J with another number but for every card with 5 there should be J on the other.
The card turned over to check this rule should be 5.

V(x): The character on visible side of card x is 5
C(y): The character on the side turned over of card x is J
The rule can be universally quantified as: $\forall x(V(x) \rightarrow C(x))$