COMPSCI 383 – Fall 2020

Homework 4

Due Wednesday, November 4th at 11:59pm ET

You are encouraged to discuss the assignment in general with your classmates, and may optionally collaborate with one other student. If you choose to do so, you must indicate with whom you worked. Multiple teams (or non-partnered students) submitting the same code will be considered plagiarism.

1. Vampires Lie

While traveling through the Transylvanian countryside, you come upon a house in the woods. Upon entering the house, you are greeted by two creepy people named Drusilla and Spike. It occurs to you that one or both of them could be a vampire.

One thing you know is that while Transylvanians customarily always tell the truth, vampires always lie. In each case below, your goal is to determine whether the individuals you are talking to are vampires or humans by examining their statements using propositional logic.

For each scenario, start with the following two propositions:

D = “Drusilla is a human”
S = “Spike is a human”

Next, construct a truth table that lists all possible truth values for the propositional logic sentence that reflects the conversation. Using the table, draw a conclusion regarding the vampire/human status of Drusilla and Spike.

(a) Drusilla points to Spike and says to you: “I am a vampire and he is not.”

(b) Spike points to Drusilla and says “If I am human then so is she.”

(c) Drusilla says “I am a vampire or he is human.”

(d) Spike says “Neither one of us are human”

2. Werewolves of Amherst

Consider the following sentence in propositional logic:
[(*Moon* ⇒ *Werewolf*) ∨ (*Candy* ⇒ *Werewolf*)] ⇒ [(*Moon* ∧ *Candy*) ⇒ *Werewolf*]

(a) Use truth table enumeration to determine whether this sentence is valid, satisfiable (but not valid), or unsatisfiable (feel free to abbreviate the variables as Moon, Werewolf, and Candy as M, W, and C, respectively).

(b) Convert both the left-hand and right-hand sides of the main implication (the two pieces in square brackets) into Conjunctive Normal Form (CNF), showing each step. Explain how your results confirm your answer to (a).

3. Ghostly Resolutions

Use the resolution algorithm to determine which of the following sentences are entailed by the knowledge base KB = $\neg g \vee h$ $o \vee \neg s$ $\neg t \vee g$ $u \vee \neg h$ $\neg u \vee s$

Show your work, including any rewriting of KB or the theorem sentences as well as all the resolutions you make in the course of applying the algorithm.

(a) $\neg t \vee h$

(b) $\neg s \wedge \neg t$

(c) $t \rightarrow o$