CS267A: Probabilistic Programming and Relational Learning **Spring 2020**

Homework 1: Due Wednesday Apr. 15, 11:59PM

Instructions: Upload one file to CCLE: a PDF typeset using LaTeX containing your solutions. No late submissions will be accepted. See the syllabus for policies about collaboration and academic honesty.

Problem 1

Three people, A, B, and C, are suspected of a crime. They testify as follows:

- A says: B is guilty if C is innocent.
- B says: If A is guilty, then C is also guilty.
- C says: I am innocent and at least one of the others is guilty.

Answer each of the following questions about these testimonies:

1. Write down the propositional knowledge base describing the testimony of the three people, using the variables a, b, and c to represent whether or not a person is innocent (i.e., $a = \texttt{true}$ means a is innocent).
2. Write down a truth table for the knowledge base.
3. Are the three testimonies consistent? Why or why not?
4. Assuming everyone is innocent (i.e., $a = b = c = \texttt{true}$), who lied in their testimony?
5. Assuming all the testimony is true, who is innocent and who is guilty?

Problem 2

We mentioned several SAT algorithms in the lecture. This problem is intended to encourage you to learn more about them. Check if the following sentences are SAT using *DPLL search* or *resolution* (i.e. please don't enumerate all models), and either (1) report the satisfying assignment, or (2) say that it is UNSAT. Summarize in 1 paragraph which SAT algorithm you choose and how you reach your answers using that algorithm. You are encouraged to choose different algorithms for different sub-problems.

- $(a \vee b \vee \neg c) \wedge (a \vee \neg d)$
- $\neg(a \vee b) \wedge (\neg c \vee (c \wedge d)) \rightarrow \neg c \vee d$
- $(x \vee y \vee z) \wedge (x \vee y \vee \neg z) \wedge (x \vee \neg y \vee z) \wedge (x \vee \neg y \vee \neg z) \wedge (\neg x \vee y \vee z) \wedge (\neg x \vee y \vee \neg z) \wedge (\neg x \vee \neg y \vee z) \wedge (\neg x \vee \neg y \vee \neg z)$