CS331 (Spring 2022): Introduction to Artificial Intelligence
Written Assignment #2

Date handed out: April 20, 2022
Date due: May 2, 2022 at 10:00am
Total: 25 points

The written portion of this assignment is to be done individually. Please hand in a pdf on Canvas. Assignments done on a word processor are preferred but not mandatory. For hand written assignments, if we cannot read your writing, we cannot mark your assignment.

1. Prove the following entailment in three different ways.

a) Prove that (A ⇒ ¬B) ⊨ ¬ (B ∧ A) with truth tables. **[2 points]**
b) Prove that (A ⇒ ¬B) ⊨ ¬ (B ∧ A) with logical equivalences. **[2 points]**
c) Prove that (A ⇒ ¬B) ⊨ ¬ (B ∧ A) with the resolution algorithm. **[3 points]**

2. Decide whether each of the following sentences is valid, unsatisfiable or neither. Verify your decisions using truth tables or equivalence rules.

a) $((Study \wedge Rest) \Longrightarrow Pass) \wedge (Study \Longrightarrow \neg Rest) \wedge (Rest \Longrightarrow \neg Study) \wedge Study$ **[2 points]**

b) $\big((Pass \wedge \neg Study) \Longrightarrow Rest\big) \Longrightarrow (\neg Pass \vee Study \vee Rest)$ **[2 points]**

3. Convert the following sentences to CNF.

S1. $P \Rightarrow \neg(Q \vee R)$ **[2 points]**
S2. $(P \wedge Q) \Leftrightarrow S$ **[2 points]**

4. Consider the following KB:

S1. $A \vee B$
S2. $\neg B \vee \neg C$
S3. $\neg C \vee D$
S4. $B \vee \neg E$
S5. $\neg D \vee E$

a) Use the resolution algorithm to determine whether the following KB entails $\neg D$. **[5 points]**

b) Use the resolution algorithm to determine whether the following KB entails $B \vee \neg D$.
[5 points]