

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE - CS161
Fall 2017

Assignment 5: due Thursday, November 9th, 2017, 11:59pm

- Please submit a digital copy of your solution on CCLE.
- Submitted files should be in PDF format and named "hw5.pdf".
- You may submit a scanned PDF, but it should be clear and readable.

1. (20 pts) Use truth tables (worlds) to show that the following pairs of sentences are equivalent:

- $P \Rightarrow \neg Q, Q \Rightarrow \neg P$
- $P \Leftrightarrow \neg Q, ((P \wedge \neg Q) \vee (\neg P \wedge Q))$

2. (30 pts) Consider the following sentences and decide for each whether it is valid, unsatisfiable, or neither:

- $(\text{Smoke} \Rightarrow \text{Fire}) \Rightarrow (\neg \text{Smoke} \Rightarrow \neg \text{Fire})$
- $(\text{Smoke} \Rightarrow \text{Fire}) \Rightarrow ((\text{Smoke} \vee \text{Heat}) \Rightarrow \text{Fire})$
- $((\text{Smoke} \wedge \text{Heat}) \Rightarrow \text{Fire}) \Leftrightarrow ((\text{Smoke} \Rightarrow \text{Fire}) \vee (\text{Heat} \Rightarrow \text{Fire}))$

Justify your answer using truth tables (worlds).

3. (50 pts) Consider the following:

If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

- (a) Represent the above information using a propositional logic knowledge base (set of sentences in propositional logic).
- (b) Convert the knowledge base into CNF.
- (c) Can you use the knowledge base to prove that the unicorn is mythical? How about magical? Horned?

Justify your answers using resolution by providing corresponding resolution derivations. Make sure to clearly define all propositional symbols (variables) first, then define your knowledge base, and finally give your derivations.