Intro to AI (331)
Homework 05
Borrelli
Due: Wednesday, July 14th, 2021 by 11:59pm

- Be sure to put your NAME and Section number on the first page.
- You must submit your solution to MyCourses in **PDF** format **only**.
- Late work is not accepted.
- Only the last thing submitted to the dropbox will be accepted.

1. **(8 Points)** Given the Wumpus world example from the notes. Suppose the agent has progressed to the point shown in Figure 7.4(a) on Page 239, having perceived nothing at [1,1], a breeze in [2,1], and a stench in [1,2], and is now concerned with the contents of [1,3], [2,2], [3,1]. Each of these can contain a pit, and at most one can contain a wumpus. Following the example of Figure 7.5, construct the set of possible worlds (Hint: there are 32 of them). Mark the worlds in which KB is true and those in which each of the following sentences is true:

   $\alpha 2$ = "There is not pit in [2,2]"
   $\alpha 3$ = "There is a wumpus in [1,3]"

   Hence show that $KB \models \alpha 2$ and $KB \models \alpha 3$.

2. **(8 Points)** Use a truth table to show that
   $\{p \rightarrow q, (m \rightarrow p \vee q), m\} \models q$

3. **(4 Points)** Use a direct proof (not proof by contradiction) to show the following.

   $p \rightarrow q$

   $q \rightarrow r$

$\vdash p \rightarrow r$

For each step of the proof, indicate the premise and the logic rule used. Use only the rules from the notes.

4. **(10 Points)** Which of the following are correct? If they are incorrect, show the truth assignments that show it. (Hint: Look at page 249 in R&N.)

   (a) $False \models True$

   (b) $True \models False$

   (c) $(A \wedge B) \models (A \Leftrightarrow B)$

   (d) $(A \Leftrightarrow B) \models A \vee B$

   (e) $(A \wedge B) \rightarrow C \models (A \rightarrow C) \vee (B \rightarrow C)$

5. **(12 Points)** Given the following, prove the deduction by (a) a direct proof and (b) a Reductio Ad Absurdum (proof by contradiction). For each step of the proof, indicate the premise and the logic rule used.

   $H \rightarrow I \wedge J \rightarrow K$

   $(I \vee K) \rightarrow L$

   $\neg L$

   $\vdash \neg(H \vee J)$

6. **(8 Points)** Convert the following to CNF notation:
   Hint: implication has a higher precedence than AND or OR.

   (a) $C \wedge F \rightarrow \neg B$

   (b) $\neg B \rightarrow (C \wedge D \wedge E)$

   (c) $(A \vee B) \Leftrightarrow (C \wedge D)$