

# Homework #3

**Due** Mar 12 by 6pm      **Points** 100      **Submitting** a text entry box or a file upload  
**File Types** pdf, txt, and jpg      **Available** until Mar 19 at 6pm

This assignment was locked Mar 19 at 6pm.

This homework will be graded out of 100 points. It will count 6% of the grade. The homework has to be done individually, no collaboration with other student and no copying answers from anyone/anywhere. Homeworks are due on Friday at 6:00pm. Late homeworks will lose 10% of the maximum total points for each day they are late. Weekends do not count, so if you submit by 6:00pm on Monday you lose only 10%.

Submit the assignment electronically using canvas. The written part has to be uploaded as a .pdf file. Please do not submit word files! Please also avoid submitting handwritten answers, unless your handwriting is very easy to read and the image is clear.

1. [30 points] Decide if the following sentences are valid, unsatisfiable, or neither. To do it, use the truth tables and equivalency rules in Chapter 7.
  1.  $\text{Cold} \Rightarrow \text{Cold}$
  2.  $\text{Cold} \Rightarrow \text{Wet}$
  3.  $(\text{Cold} \Rightarrow \text{Wet}) \Rightarrow (\neg \text{Cold} \Rightarrow \neg \text{Wet})$
  4.  $\text{Cold} \vee \text{Wet} \vee \neg \text{Wet}$
  5.  $((\text{Cold} \Rightarrow \text{Wet}) \Rightarrow (\text{Wet} \Rightarrow \text{Cloudy}))$
  6.  $(\text{Cold} \Rightarrow \text{Cloudy}) \Rightarrow ((\text{Cold} \wedge \text{Wet}) \Rightarrow \text{Cloudy})$
  7.  $\text{Warm} \vee \text{Sunny} \vee (\text{Warm} \Rightarrow \text{Sunny})$
  8.  $(\text{Warm} \wedge \text{Sunny}) \vee \neg \text{Sunny}$
  9.  $((\text{Rain} \Rightarrow \text{Wet}) \wedge (\text{Wet} \Rightarrow \text{Cold})) \Rightarrow (\text{Rain} \Rightarrow \text{Cold})$
  10.  $((\text{Rain} \vee \text{Wet}) \wedge (\neg \text{Wet} \vee \text{Cold})) \Rightarrow (\text{Rain} \vee \text{Cold})$
2. [20 points] For each of the following formulas, state briefly if it is a correct representation in propositional calculus of the sentence "If the dog sleeps and the house is warm, then the night is quiet." or not and explain why. The propositions used in the sentences should have an obvious interpretation.
  1.  $\text{DogSleeps} \wedge \text{HouseWarm} \wedge \text{NightQuiet}$
  2.  $(\text{DogSleeps} \wedge \text{HouseWarm}) \Rightarrow \text{NightQuiet}$
  3.  $(\text{DogSleeps} \vee \text{HouseWarm}) \Rightarrow \text{NightQuiet}$
  4.  $\text{NightQuiet} \Rightarrow (\text{DogSleeps} \wedge \text{HouseWarm})$
  5.  $\neg \text{DogSleeps} \vee (\neg \text{NightQuiet} \vee \text{HouseWarm})$
3. [25 points] Convert the following set of propositional clauses to CNF and prove, by resolution **with refutation**, that "Pleasant" is entailed by the knowledge base. Show the steps in the resolution proof.
  1.  $(\text{Cold} \wedge \text{Dry}) \Rightarrow \text{Pleasant}$
  2.  $\text{January} \Rightarrow (\text{Winter} \wedge \text{Wet})$
  3.  $\text{Winter} \Rightarrow \text{Dry}$
  4.  $\text{Wet} \Rightarrow \text{Cold}$
  5.  $\text{January}$
4. [25 points] This question requires to use resolution **with refutation** for propositional logic. First, convert the following sentences to CNF:

1.  $\neg A \Rightarrow (B \vee C)$
2.  $A \Rightarrow B$
3.  $\neg (\neg B \Rightarrow D)$
4. Prove " $C \wedge \neg D$ " using resolution with refutation. Show the steps in the resolution proof.

HW3 rubric												
Criteria	Ratings											Pts
Question 1 Graded by: Trevor	30 pts Full Marks	27 pts 1 wrong	24 pts 2 wrong	21 pts 3 wrong	18 pts 4 wrong	15 pts 5 wrong	12 pts 6 wrong	9 pts 7 wrong	6 pts 8 wrong	3 pts 9 wrong	0 pts No Marks	30 pts
Question 2 Graded by: Fei	20 pts Full Marks	16 pts issue with 1 question		12 pts issue with 2 questions		8 pts issue with 3 questions		4 pts issue with 4 questions		0 pts No Marks		20 pts
Question 3 Graded by: Robert	25 pts Full Marks	20 pts Minor mistakes in proof or CNF conversion			15 pts Incorrect proof by refutation Conversion to CNF is correct		10 pts Proof incorrect and minor mistakes in CNF conversion			0 pts No Marks		25 pts
Question 4 Graded by: Ben	25 pts Full Marks	25 to >20.0 pts Minor Issues Issues with 1 conversion to CNF, or minor issues with resolution proof.			20 to >15.0 pts Issues with resolution Issues with resolution proof or issues with multiple CNF conversions.			15 to >0.0 pts Major issues Major issues		0 pts No Marks		25 pts
Total Points: 100												