Homework #4

New Attempt

Due Mar 26 by 6pm **Points** 100 **Submitting** a text entry box or a file upload
File Types pdf, txt, and jpg

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. Uploaded your answers as a .pdf or .txt file. Please avoid submitting handwritten answers, unless your handwriting is very easy to read and the .jpg image is clear.

1. [25 points] For each of the following English sentences, decide if the logic sentence is a correct translation or not. If not explain why not and correct it. Look at then carefully to make sure you spot the mistakes:
   1. There is only one house in Minneapolis that is pink.

      $\exists x$ House(x) $\wedge$ In(x,Minneapolis) $\wedge$ $\forall y$ [House(y) $\wedge$ In(y,Minneapolis) $\Rightarrow$ Color(x,Pink) $\wedge$ (x=y)]

   2. There is a house that is bigger than any apartment.

      $\forall x$ Apartment(x) $\Rightarrow$ [$\exists y$ House(y) $\wedge$ Bigger(y,x)]

   3. Every apartment is cheaper than every house.

      $\forall x$ Apartment(x) $\Rightarrow$ [$\exists y$ House(y) $\wedge$ Cheaper(x,y)]

   4. Some farms cost less than some houses.

      $\exists x$ Farm(x) $\wedge$ [$\exists y$ House(y) $\Rightarrow$ Cheaper(x,y)]

   5. All houses have at least one bathroom.

      $\forall x$ [house(x) $\wedge$ $\exists y$ bathroom(y)] $\Rightarrow$ in(x,y)

2. [15 points] You are given the English sentence "Only pink objects are in the box." and different logical expressions:
   1. $\exists x$ InBox(x) $\Rightarrow$ Pink(x)
   2. $\forall x$ InBox(x) $\wedge$ Pink(x)
   3. $\exists x$ InBox(x) $\wedge$ Pink(x)
   4. $\forall x$ Pink(x) $\Rightarrow$ InBox(x)
   5. $\exists x$ Pink(x) $\wedge$ inBox(x)

   Is any of the logical expressions a correct translation from English to logic? if yes, which one(s)? For each of the logical sentences that are not a correct translation of the sentence given above, write in English what the logical sentence is actually saying.
3. [20 points] Convert the following expressions in propositional and predicate logic to CNF:
   1. [B $\vee$ (A $\wedge$ C)] $\Rightarrow$ (B $\vee$ $\neg$ A)
   2. [Q $\wedge$ (S $\vee$ R)] $\Rightarrow$ W
   3. $\forall p$ [[Pet(p) $\wedge$ $\exists c$ [Owner(c,p) $\vee$ Feeds(c,p)]] $\Rightarrow$ Happy(p)]
   4. $\forall x$ $\exists y$ $\forall z$ [P(x,y,z) $\Rightarrow$ $\exists u$ Q(x,u)]

4. [20 points] Prove using resolution with refutation that ¬H(C) is entailed by this knowledge base expressed in CNF. Capital case letters used as arguments indicate constants, lower case letters are variables.
   1. ¬F(u,x) ∨ ¬H(x)
   2. ¬G(w) ∨ ¬F(w,y) ∨ F(y,z)
   3. F(A,B)
   4. G(A)
5. [20 points] Represent the following sentences in predicate calculus, using the predicates Cat(x), Bird(y), Eat(x,y), and Hate(x,y).
   1. Bill hates all cats which eat birds.
   2. Felix is a cat.
   3. Felix ate a bird.

   Convert each of them to conjunctive normal form and prove by resolution with refutation that "Bill hates Felix".

HW4

Criteria	Ratings										Pts
Question 1 Graded by Trevor	**25 pts** **Full Marks**	**23 pts** **1 wrong, partial credit**	**20 pts** **1 wrong**	**18 pts** **2 wrong, partial credit**	**15 pts** **2 wrong**	**13 pts** **3 wrong, partial credit**	**10 pts** **3 wrong**	**8 pts** **4 wrong, partial credit**	**5 pts** **4 wrong**	**3 pts** **5 wrong, partial credit**	**0 pts** **No Marks**	25 pts
Question 2 Graded by Ioanna expressions: 3 points each - correct answer, mistakes: -1 - incorrect answer, somewhat meaningful explanation: -1 to -2	**15 to >14.0 pts** **Full Marks**	**14 to >12.0 pts** **minor mistakes**	**12 to >8.0 pts** **Some mistakes**	**8 to >0.0 pts** **Incorrect answer (major mistakes)**							**0 pts** **No Marks**	15 pts
Question 3 Graded by Ben	**20 pts** **Full Marks**	**15 pts** **Mistake in 1 step**	**10 pts** **Mistakes in 2 steps**	**5 pts** **Mistakes in 3 Steps**							**0 pts** **No Marks**	20 pts
Question 4 Graded by Fei	**20 pts** **Full Marks**	**15 pts** **mistake in one step**	**10 pts** **mistakes in two steps**	**5 pts** **mistakes in three steps**							**0 pts** **No Marks**	20 pts
Question 5 Graded by Robert	**20 pts** **Full Marks**	**15 pts** **Proof Incorrect** Conversion to CNF is correct	**10 pts** **Minor Mistakes Convert to CNF, Proof incorrect**	**5 pts** **Major mistakes converting to CNF, proof incorrect**							**0 pts** **No Marks**	20 pts
												Total Points: 100