ICS6B Assignment 1

Due: Thursday, 12th April, 2018   By 7am on Gradescope

1 Propositional Logic and Equivalences

1. Tautologies Which of the following is a tautology? There may be more than one.

   (a) $p \implies \neg q$
   (b) $(p \implies q) \implies (\neg q \implies \neg p)$
   (c) “It’s no exaggeration that the undecideds can go one way or another.”
   (d) “To be or not to be, that is the question.”
   (e) The product of two irrational numbers is irrational.

2. Contradiction Show that the following is a contradiction:
   $(p \equiv \neg p)$

3. Possibilities Which of the following is a contingency? There may be more than one.

   (a) An integer $n$ selected at random is even.
   (b) Any prime number greater than six is odd.
   (c) Next week Tuesday there will be no cars on East Peltason Drive from 10am to 1pm.
   (d) A girl’s grandmother’s uncle’s great-granddaughter is her third cousin.
   (e) The square root of an integer $n$ is another integer.

4. True or not? Is the following true? Show your work.
   $\neg(p \land q) \equiv (\neg p \lor \neg q)$

5. Exam Woes Due to many requests from students to postpone a mid-term exam scheduled for the next day, a professor attempts to pacify her class by saying, “It will rain if I cancel tomorrow’s midterm.” The next day, there were thundershowers all day. In spite of this, some students happily went to class without studying. Upon entering the classroom, they were disappointed to see the professor handing out question papers for the midterm. Explain carefully how they misinterpreted the professor.
6. **Mythical Island Creatures** You are on an island whose inhabitants are either elves or dark wizards. Elves always speak the truth and dark wizards always lie. Unfortunately for you, they all look the same. You meet three natives - Preston, Sina and Ali, and the following conversation ensues:

You (to Preston): How many elves are in your group?

Preston (mumbles): —– (You are unable to hear his reply)

You (to Sina): What did he say?

Sina: Preston said that there is one elf among us.

Ali: Don’t believe Sing, he is lying.

Is it possible to determine each of their types? Show your work.