Maggie Johnson

due: 1/19, 135 points

Problem Set #1

You will be doing several problem sets in CS109 over the course of the quarter. Working problems in 109 is the key to really getting the material down. This is why the problem sets (and all the other problems in the textbook) are so important. Remember, if you choose to work with a partner, it is essential that you both work on the problems together. That's not only the rule in this class, it is also best for you.

Some problem sets will be more challenging than others, depending on your mathematical background and on the nature of the material covered. When you encounter a problem that you find especially tough, there's a well-known approach to arriving at a solution: Try working on the problem repeatedly between periods of other activity, like sleeping. Go as far as you can, and then just quit. See what happens the next morning. Often you will find that you have made progress. This approach works because supposedly, the unconscious mind works much faster than the conscious mind. Many of the problems that you will have to solve on the 109 problem sets may require this approach, so it is important to give yourself the time you need by starting early.

Finally, the textbook and student solution guide are excellent sources of ideas for solving many of the problems on problem sets. You will find models for many of the problems below in the textbook and solution guide. Studying and solving lots of problems is the best way to sharpen your skills.

Propositional Logic

Rosen, Section 1.1:

#8 a, b, e, f (3 points each)
#24 e (5 points)

Rosen, Section 1.2:

#8 d (3 points)
#18 (5 points) - do this without using a truth table.
#36 (10 points)
#40 (10 points) - do a careful proof of this...

Propositional Logic Proofs

1) Represent the following statements using propositional variables. Then prove or disprove the conclusion. If you prove it, give a complete list of steps with rules of inference; if you disprove, explain in detail why. (10 points)

> If Fred does not live in France, then he does not speak French.
> Fred does not drive a Miata.
> If Fred lives in France, he rides a bike.
> Either Fred speaks French or he drives a Miata.
> Hence, Fred rides a bike.

2) Is the following inference pattern valid? (note "t" is a propositional variable) If you prove it, give a complete list of steps with rules of inference; if you disprove, explain in detail why. (10 points)

> (p ^ q) -> ~t
> w v r
> w -> p
> r -> q
> ---------------
> (w v r) -> ~t

Predicate Logic

Rosen, Section 1.3:

> #12 a-j (2 points each)
> #18 a-e (4 points each)
> #42 (10 points)

Resolution

Prove the following using resolution. Convert to conjunctive normal form as needed. (10 points each)

1) (q -> r), (p -> q), (p v q) |- r

2) [(p ^ q) -> r], (r -> ~p), (~q -> ~p), (~r -> p) |- r