1. ☐ 10 pts. each ☐ Write the negation of each statement.

   (a) No prions can be seen.

   (b) Some Vulcans are illogical.

   (c) All math courses are loads of fun.

2. ☐ 10 pts. each ☐ Identify each sentence as a simple or compound statement (or neither). If a sentence is a compound statement, state whether it's a negation, conjunction, disjunction, conditional, or biconditional.

   (a) Who controls the present controls the past.

   (b) How many fingers am I holding up, Winston?

   (c) It is not the case that anarcho-syndicalists are Leninists or Trotskyists.

   (d) Everyone studied algebraic topology at Old Country Buffet but not everyone aced the exam.

   (e) You will not trifle with my physics experiment, or if you do trifle with it then you will pay the price for your lack of vision.

3. ☐ 10 pts. each ☐ Let
   p: *Mr. Freeze was foiled last week.*
   q: *Two-Face is in town.*
   r: *Batman is on vacation.*
   s: *The Mad Hatter is off his meds.*

   Write the following in symbolic form.

   (a) If Mr. Freeze was foiled last week and Two-Face is not in town, then Batman is on vacation.

   (b) Two-Face is in town if and only if Batman is on vacation or Mr. Freeze was foiled last week.

   (c) It is false that Batman is not on vacation and Mr. Freeze was not foiled last week.

   (d) Mr. Freeze was foiled last week and Batman is on vacation, or Two-Face is in town and the Mad Hatter is off his meds.

4. ☐ 10 pts. each ☐ Use De Morgan's laws to determine whether the statements are equivalent.

   (a) $\sim(p \wedge q), \quad \sim(\sim q \wedge \sim p)$

   (b) $\sim(p \to \sim q), \quad p \wedge q$

5. ☐ 10 pts. each ☐ Make a truth table for each statement, and determine whether it's a tautology, contradiction, implication, or none of these.

   (a) $\sim(p \wedge \sim q)$

   (b) $q \to (p \to \sim q)$

   (c) $q \to (p \vee q)$

   (d) $(q \wedge \sim p) \leftrightarrow (p \vee \sim q)$

   (e) $(\sim p \to q) \vee \sim p$

6. ☐ 10 pts. ☐ Use a truth table to determine whether the statements $q \leftrightarrow (p \wedge \sim r)$ and $q \to (p \vee r)$ are equivalent.

7. ☐ 10 pts. ☐ Use the fact that $p \to q$ is equivalent to $\sim p \vee q$ to rewrite the statement "Either the clowns in Congress will listen to the people or the system doesn't work."

8. ☐ 10 pts. ☐ Write the contrapositive of the statement "If you're not with us, then you're against us."

9. ☐ 10 pts. ☐ Determine whether the argument is valid using a truth table: $p \leftrightarrow \sim q$
$$\frac{q}{\therefore \quad \sim p}$$

10. ☐ 20 pts. ☐ Translate the argument into symbolic form, then determine whether the argument is valid:

    "The engineering courses are hard and the chemistry labs are long. If the chemistry labs are long, then the art tests are easy. Therefore the engineering courses are hard and the art tests are easy."