Homework 3
Due date: 2/01

Note: Only the problems that are boxed will be graded.

Part I

1. Let $p$ be “Today is Friday” and let $q$ be “Today is Monday.” Write English sentences representing
   (a) conjunction of $p$ and $q$
   (b) disjunction of $p$ and $q$
   (c) negation of $p$.

2. Let $p$ be “Dagwood loves Blondie” and let $q$ be “Blondie loves Dagwood.” Write English sentences representing the following statements.
   (a) $\sim (p \lor q)$,
   (b) $\sim p \land \sim q$,
   (c) $\sim (p \land q)$.
   What is the difference, if any, between (b) and (c)?

3. Write negations of the following statements.
   (a) Some women are teachers.
   (b) Nothing is certain but death and taxes.
   (c) All your contributions are deductible.

4. Let $p$ be “Today is Friday” and let $q$ be “Tomorrow is Saturday.” Write an English sentence representing the negation of each of the following statements.
   (a) $p \land q$
   (b) $p \land \sim q$
   (c) $p \lor q$
5. By forming disjunctions of the basic conjunctions, you can write statements with given truth tables. Complete the following truth table by finding appropriate statements.

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6. Let $p$ be “Eva is a high school graduate” and let $q$ be “Eva is over 16 years old.”

(a) What are the logical values of $p$ and $q$ that make the statement “Eva is neither a high school graduate nor over 16 years old” true?

(b) What are the logical values of $p$ and $q$ that make the statement in part (a) false?

(c) What are the logical values of $p$ and $q$ that make the statement “Either Eva is a high school or she is over 16 years old” true?

(d) What are the logical values of $p$ and $q$ that make the statement in part (c) false?

7. Find all the number replacements for $x$ that make each of the following sentences true. Explain why!

(a) If $2 + 2 = 4$, then $x - 2 = 5$.

(b) If $2 + 2 = 22$, then $x - 2 = 5$.

(c) If $x + 2 = 6$, then $3 + 2 = 5$.

(d) If $x + 2 = 6$, then $2 + 2 = 32$.

8. Let $p$ be “I kiss you once” and let $q$ be “I kiss you again.” Under which conditions is the statement $p \rightarrow q$ false? Explain!

9. Here is an excerpt from an automobile insurance policy. “If the loss is $50 or less, we will not make any payment.” A policyholder suffers a $75 loss. What are the insurance company’s options? Explain!
**Part II**

1. Let $p$ be “Robin can type” and let $q$ be “Robin takes shorthand.” Write the statement “It is not the case that Robin can type and take shorthand” in symbolic form.

2. Let $g$ be “He is a gentleman” and let $s$ be “He is a scholar.” Write the following statements in symbolic form.

   (a) It is not true that he is a gentleman or a scholar.

   (b) He is a gentleman or a scholar.

   (c) He is a gentleman or not a scholar.

3. To qualify for a $40,000 loan, an applicant must have a gross income of $30,000 if single ($50,000 combined income if married) and assets of at least $10,000. Which of the following three applicants (if any) would qualify for the loan?

   (a) Mr. Perez is married, with two children, and makes $35,000 at his job. His wife does not work.

   ○ He qualifies ○ He does not qualify

   (b) Ms. Jefferson and her husband have assets of $50,000. One makes $22,000, the other makes $19,000.

   ○ She qualifies ○ She does not qualify

   (c) Tran Quang is a bachelor and works at two jobs. He makes $28,000 at one job and $5000 at the other; his only asset is a $7000 Toyota.

   ○ He qualifies ○ He does not qualify

4. The chairperson of the city council told the members that if they declared a holiday, at least one of the ten banks in the city would remain open. The chairperson was mistaken. Check those of the following statements (if any) that are consistent with this situation.

   ○ The council did not declare a holiday and all the banks remained closed.

   ○ The council did not declare a holiday and all the banks remained open.

   ○ The council declared a holiday and none of the banks remained closed.

   ○ The council declared a holiday and none of the banks remained open.
5. Let \( g \) be “I go to college” and let \( j \) be “I join the army.” Suppose that \( g \) is false and \( j \) is true. Check those statements below (if any) that are true.

- Either I go to college or I join the army.
- I go to college or I do not join the army.
- I neither go to college nor join the army.
- I go to college or I join the army, but not both.
- I do not go to college and I do not join the army.

6. Complete the following truth table.

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7. Find the truth value of the statement “If \( 2 + 2 = 22 \), then \( 8 = 4 + 4 \).”

- True
- False

8. Let \( p \) be “I will buy it” and let \( q \) be “It is a poodle.” Translate each statement into symbolic form.

(a) If it is a poodle, then I will buy it.
(b) If I will buy it, then it is a poodle.
(c) It is a poodle if and only if I will buy it.
(d) If it is not a poodle, then I will not buy it.
(e) If I will not buy it, then it is not a poodle.
(f) I will buy it if it is not a poodle.
(g) If it is a poodle, then I will not buy it.
9. Use the equivalence \( p \rightarrow q \Leftrightarrow \sim p \lor q \) to write the statement “If Mida is home by 5 (h), then dinner will be ready by 6 (r)” in symbolic form using only \( \sim \) and \( \lor \).

10. Which of the following statements is logically equivalent to “If you want to buy organic food, you have to let your grocer know”?

   (a) You want to buy organic food, or you let your grocer know.
       - Equivalent
       - Not equivalent

   (b) If you do not let your grocer know, then you do not want to buy organic food.
       - Equivalent
       - Not equivalent

   (c) If you let your grocer know, then you want to buy organic food.
       - Equivalent
       - Not equivalent

   (d) If you do not want to buy organic food, then you do not let your grocer know.
       - Equivalent
       - Not equivalent