Introduction

Students will work in groups using propositional logic, truth tables, and logic operations.

Assignment Goals

- Prerequisite Knowledge
  - Know what a *proposition* and a *predicate* are.
  - Knowledge of *truth tables*
- Learning Outcomes
  - Show logical equivalence by showing two columns of a truth table are the same.
  - Prove deMorgan's Law and distributive rule for logic operations.

Procedure

Get out paper. The group will turn in *one* document. Place all the names of group members attending atop the page.
Copy each question before the answer. This makes the answer sheet a worthwhile study guide w/o the worksheet. The answers written down should be *discussed* by the group and represent the *consensus* of the group. Sometimes a *picture*, a *graph*, or something similar is the most appropriate way to answer a question.
Assign Roles. Students should take roles they have not held recently (or, perhaps, ever):

Manager Move discussion forward.
Reflector Monitor that everyone gets heard and is caught up. (This is a **group** obligation, really.)
Recorder Writes the report.

Answer these questions.

1. Expand $\sum_{j=10}^{14} j \mod 6$.
2. Given simple propositions a and b, explain, in English, the difference between $a \wedge b$ and $a \vee b$? When is each *compound* proposition true? When false?
3. We have been practicing *propositional algebra*.
   (a) What is the difference between a **simple** proposition and a **compound** proposition in a propositional logic statement?
   (b) List the *variables* in the propositional logic statement $(f \wedge w) \oplus \neg(t \Rightarrow m)$.
   (c) What do the variables in a propositional algebraic statement, such as that above, stand for?
   (d) List the *operators* in the logic statement above.
   (e) Describe, in English, what each of the operators in the above statement *means*.
4. In propositional algebra:
   (a) List all of the *unary* operators that we know and explain their meaning.
   (b) List all of the *binary* operators that we know and explain their meaning.
5. Set aside some space for a wide truth table.
   In one truth table, show the truth value of $\neg(z \wedge k)$, $(z \vee k)$, $\neg z \wedge \neg k$, $(z \wedge k)$, $\neg z \vee \neg k$, $\neg(z \vee k)$, $\neg z \vee k$, and $z \vee \neg k$.
6. Looking at the solution to the previous question, which of the compound propositions are *logically equivalent*? How do you know?

7. Which of the compound propositions in the table above are logically equivalent to $z \Rightarrow k$?

8. In English: what is the difference between $a \oplus b$ and $a \vee b$?

9. Dr. Ladd claims that *divides*, $|$, is a *predicate*. Do you agree with him? What is the retturn type (or result type, if you prefer) does $k|t$ have?

10. Given the *predicate* $gt(a,b) ::= a > b$ (gt is for "greater than"). gt determines if one integer parameter, a, is greater than it other integer parameter, b.
    (a) What is $gt(9,7)$? $gt(-5,-178)$? $gt(1,2)$? $gt(2^5,3^4)$?
    (b) How many *parameters* does the function gt take?
    (c) What is the **type** of each of the parameters (in order from left to right)?
    (d) Is $g(x,17)$ a *proposition*? Explain your answer.