

Learning Outcomes

Upon completing this homework, students should be able to

- **Manipulate** modern logic notation.
- Draw **truth tables** for different numbers of basic propositions.
- **Simplify** compound propositions.

Assignment

1. What is the difference between a *preposition* and a *predicate*?
2. Which of the following are or are *not* propositions? Explain why or why not.
 - (a) $even(5)$.
 - (b) $y \leq 0$
 - (c) $odd(z)$.
 - (d) One of the suits in a deck of cards is *green*.
 - (e) $15 \geq 90$
3. Draw the truth table for each of the following logical expressions (you may make one *wide* table if you like):
 - (a) $p \wedge q$
 - (b) $p \vee q$
 - (c) $\neg p$
 - (d) $p \Rightarrow q$
 - (e) $p \oplus q$
4. Given *compound* propositions J and K , **define** $J \equiv K$ (J is logically equivalent to K).
5. Given the statement "If you drive over 100kmh, then you will get a speeding ticket.", we can define two *propositions* to translate it into a logic statement.
Let $S ::=$ "You drive over 100kmh" and $T ::=$ "You get a speeding ticket."
 - (a) Express the implication in terms of the variables, \neg , and \Rightarrow .
 - (b) Let $U ::=$ "You do **not** get a speeding ticket". Write the original implication in terms of S and U (without using T). Use only \Rightarrow and \neg as above.
6. Given the statement: Dr. Ladd bakes bread whenever there is flour in the house.
 - (a) Define two simple propositions that can be combined to make this implication.
 - (b) Use your propositions to express the statement as an implication
 - (c) Write and label the *inverse*, *converse*, and *contrapositive* for the implication.
 - (d) Translate each related implication in the problem above back into English.

7. Rewrite $y \Rightarrow z$ as a *disjunction* or explain why it is impossible. (Remember **Deduction Through the Ages.**)
8. Rewrite $y \Rightarrow z$ as a *conjunction* or explain why it is impossible. (Remember **Deduction Through the Ages.**)
9. Simplify the logical expression $\neg((e \Rightarrow h) \wedge (\neg(n \vee r) \wedge v))$
10. How many rows would there be in a truth table for the expression in question 9?
11. **Prove**, using truth tables, that $((r \Rightarrow s) \wedge (s \Rightarrow t)) \Rightarrow (r \Rightarrow t)$ is a *tautology*.
12. List the members of \mathbb{Z}_8 .
13. What does $\neg(3|n)$
 - (a) Mean in English?

Submit your answers electronically, in a commonly readable format (e.g. .pdf, .txt, .docx), through BrightSpace. If you photograph hand-written answers please make sure there is enough contrast that I can read them and *please* put all the pages in a single file (Adobe Scan is available on Android and iOS).