

Deadline: September 30, 5pm. Please upload your assignment to Moodle by this time, and also bring a paper copy to class on next day. This assignment will be graded anonymously, so please don't list your name, but only your MAC ID.

As noted by the syllabus as well as in class, the scope, content, and convention of assignments are set by lectures, instead of any specific textbook. Please beware that different textbooks may use different symbolism or definitions.

Assignments are meant to be challenging! You are encouraged to discuss your answers with other students (but write up your own answers individually).

1. Insert parentheses in the following expressions according to the grouping convention, so as to ensure unique readability. (Do not add parentheses if there is no danger of ambiguity.)

After inserting the required parentheses, write down the truth-tables for the following. Please make sure you list all the intermediate steps.

1. $\neg(\neg A \wedge \neg(B \wedge A))$
2. $\neg(\neg A \wedge \neg(B \wedge C)) \wedge (A \wedge B)$
3. $\neg(A \wedge (\neg A \wedge \neg B))$
4. $\neg(A \wedge (\neg A \wedge \neg C)) \wedge \neg\neg B$
5. $C \wedge \neg(C \wedge \neg(A \wedge C))$
6. $A \wedge \neg(C \wedge (\neg C \wedge B))$

2. Suppose that \vee^x is a connective that corresponds to exclusive 'or' (i.e., $A \vee^x B$ is true just when one of A and B is true, but not both.) Show that disjunction can be expressed using \wedge and \vee^x (without using negation); in other words, using only \wedge and \vee^x , construct a sentence whose truth-table column is exactly that of $A \vee B$. (This is easier than it looks.)

It's recommended that you list both the truth tables, so even if your final result is not fully correct, you might still be able to receive partial credit.

3. Express the following texts as sentential expressions using sentential variables and connectives that we have learned before September 23 (that is, negation, conjunction, and disjunction). Also explain what each sentential variable represents; for example, A: Alex is happy. Indicate relevant ambiguities, as you find them, and formalize each of the readings.
- At least two of Ann, Barbara and Claire are unmarried.
 - The telephone is disconnected.
 - Charles is rich but he's not happy; Charles wants to be happy.
 - Democracy is a form of government which may be rationally defended, not as being good, but as being less bad than any other.
 - Neither Zoey nor I are knaves.
4. You are on an island where there are two kinds of inhabitants: (1) Knights, who always tell the truth; (2) Knaves, who always lie. You meet two inhabitants: Zoey and Mel. Zoey tells you that Mel is a knave. Mel says, "Neither Zoey nor I are knaves." Can you determine who is a knight and who is a knave?

It's recommended that you construct a truth table to solve this puzzle, like what we did in class.