Boolean Algebra

The first test will cover material from Quizzes 1 and 2 (similar questions, but different) and at least 2 questions taken directly from the following problem set.

Note: Bender and Williamson use $\sim$ instead of $\neg$, and call Boolean expressions "Boolean functions".

1. Unit BF, question 1.1 (p8).
2. Unit BF, question 1.2 (p8).
3. Unit BF, question 1.3 (p8).
4. Unit BF, question 1.5 (p8).
5. Unit BF, question 1.9 (p8) (if they are not equal, give a counterexample, if they are equal, prove it).
6. Unit BF, question 1.12 (p8) (if they are not equal, give a counterexample, if they are equal, prove it).
7. Unit BF, question 1.13 (p8) (if they are not equal, give a counterexample, if they are equal, prove it).
8. Unit LO, question 1.8 (page 36).
9. Unit LO, question 1.10 (page 36).
10. Prove: $\neg(x \Rightarrow y) = x \wedge (\neg y)$.
11. Unit LO, question 1.11 (page 36).
12. Prove: $(x \vee y) \Rightarrow z = (x \Rightarrow z) \wedge (y \Rightarrow z)$.
13. Prove that $x \vee y = \neg((\neg x) \wedge (\neg y))$ and $x \Rightarrow y = (x \wedge y) \vee ((\neg x) \wedge (\neg y)$.

    Explain why these results, together with the fact that $x \Rightarrow y = (\neg x) \vee y$ mean that all the boolean algebra operations can be expressed in terms of $\wedge$ and $\neg$.
14. Prove that $x \underline{\vee} y = (x \wedge (\neg y)) \vee ((\neg x) \wedge y)$.
15. The boolean operation *nand* is defined by $x \overline{\wedge} y = \neg(x \wedge y)$.

    Construct a truth table for nand.

    Is nand commutative or associative?

    Show that $x \wedge y$ and $\neg x$ are logically equivalent to expressions involving only nand operations.