

This problem set focuses on material covered in Lectures 1 and 2, so I recommend you to watch both lectures and attempt Assignments 1 and 2 before submitting your answers.

1. Is it possible for one of  $(\phi \wedge \psi) \wedge \theta$  and  $\phi \wedge (\psi \wedge \theta)$  to be true and the other false? (If not, then the associative property holds for conjunction.)
2. Is it possible for one of  $(\phi \vee \psi) \vee \theta$  and  $\phi \vee (\psi \vee \theta)$  to be true and the other false? (If not, then the associative property holds for disjunction.)
3. Is it possible for one of  $\phi \wedge (\psi \vee \theta)$  and  $(\phi \wedge \psi) \vee (\phi \wedge \theta)$  to be true and the other false? (If not, then the distributive property holds for conjunction across disjunction.)
4. Is it possible for one of  $\phi \vee (\psi \wedge \theta)$  and  $(\phi \vee \psi) \wedge (\phi \vee \theta)$  to be true and the other false? (If not, then the distributive property holds for disjunction across conjunction.)
5. Is showing that the negation  $\neg\phi$  is true equivalent to showing that  $\phi$  is false?
6. Assuming you know nothing more about Alice, which of (a) – (e) is most likely? (Or does (f) hold?)
  - (a) Alice is a rock star and works in a bank.
  - (b) Alice is quiet and works in a bank.
  - (c) Alice is quiet and reserved and works in a bank.
  - (d) Alice is honest and works in a bank.
  - (e) Alice works in a bank.
  - (f) None of these is more or less likely.
7. Assuming you know nothing more about Alice, which of (a) – (e) is most likely? (Or does (f) hold?)
  - (a) Alice is a rock star or she works in a bank.
  - (b) Alice is quiet and works in a bank.
  - (c) Alice is a rock star.
  - (d) Alice is honest and works in a bank.
  - (e) Alice works in a bank.
  - (f) None of these is more or less likely.
8. Identify which of the following are true (where  $x$  denotes an arbitrary real number). If you do not select a particular statement, the system will assume you think it is false.
  - (a)  $(x > 0) \wedge (x \leq 10)$  means  $0 \leq x \leq 10$
  - (b)  $(x \geq 0) \wedge (x^2 < 9)$  means  $0 \leq x < 3$
  - (c)  $(x \geq 0) \wedge (x \leq 0)$  means  $x = 0$
  - (d) There is no  $x$  for which  $(x < 4) \wedge (x > 4)$
  - (e)  $-5 \leq x \leq 5$  means  $x$  is at most 5 units from 0.
  - (f)  $-5 < x < 5$  implies that  $x$  cannot be exactly 5 units from 0.
  - (g)  $(x \geq 0) \vee (x < 0)$
  - (h)  $(0 = 1) \vee (x^2 \geq 0)$
  - (i) If  $(x > 0 \vee x < 0)$  then  $x \neq 0$ .
  - (j) If  $x^2 = 9$  then  $(x = 3 \vee x = -3)$ .