

CSE311 Quiz Section: April 05, 2012

1. Prove that $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r$ by rewriting with equivalences.
2. Prove that $(p \wedge q) \rightarrow (p \rightarrow q)$ is a tautology by rewriting with equivalences.
3. How many different Boolean functions on n variables are possible?

4. Logical equivalence with quantifiers

7th edition: 1.4: 43, 45; 6th edition: 1.3: 43, 45

Determine whether the following are logically equivalent:

- (a) $\forall x(P(x) \rightarrow Q(x))$ and $\forall xP(x) \rightarrow \forall xQ(x)$
- (b) $\exists x(P(x) \vee Q(x))$ and $\exists xP(x) \vee \exists xQ(x)$

5. Translate English to logical expressions with nested quantifiers.

Both editions: 1.5: 9

Let $L(x,y)$ be the statement "x loves y"

- (a) There is somebody whom everybody loves (c)
- (b) Nobody loves everybody (d)
- (c) There is exactly one person whom everybody loves. (g)
- (d) Everyone loves himself or herself. (i)
- (e) There is someone who loves no one besides himself or herself. (j)

6. Use inference rules with quantified premises and conclusions

7th edition: 1.6: 27, 29; 6th edition: 1.5: 27, 29

- (a) Premises: $\forall x(P(x) \rightarrow (Q(x) \wedge S(x)))$, $\forall x(P(x) \wedge R(x))$
Conclusion: $\forall x(R(x) \wedge S(x))$
- (b) Premises: $\forall x(P(x) \vee Q(x))$, $\forall x(\neg Q(x) \vee S(x))$, $\forall x(R(x) \rightarrow \neg S(x))$,
 $\exists x\neg P(x)$
Conclusion: $\exists x\neg R(x)$