

CSE 015: Discrete Mathematics
Homework #1
Solution

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Lab CSE-015-07L

February 1, 2022

Chapter 1.1

1. **Question 10:**

- (a) 10(f): If I did not buy a lottery ticket this week, then I did not win the million dollar jackpot.
- (b) 10(g): I did not buy a lottery ticket this week, and did not win the million dollar jackpot.

2. **Question 16:**

- (a) 16(a): $r \wedge \neg q$
- (b) 16(f): $r \leftrightarrow (q \vee p)$

3. **Question 20:**

- (a) 20(a): False
- (b) 20(b): False

4. **Question 34:**

- (a) 34(f):

p	q	$\neg q$	$p \leftrightarrow q$	$p \leftrightarrow \neg q$	$(p \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$
T	T	F	T	F	T
T	F	T	F	T	T
F	T	F	F	T	T
F	F	T	T	F	T

Chapter 1.3

5. **Question 12:**

- (a) 12(a):

p	q	$\neg p$	$p \vee q$	$[\neg p \wedge (p \vee q)]$	$[\neg p \wedge (p \vee q)] \rightarrow q$
T	T	F	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	F	T	F	F	T

6. Question 32:

- (a) 32: They are logically equivalent since p and q require two logic values to be exactly the same. If p and q were different, they would be false.

p	q	$\neg p$	$\neg q$	$p \leftrightarrow q$	$\neg p \leftrightarrow \neg q$
T	T	F	F	T	T
T	F	F	T	F	F
F	T	T	F	F	F
F	F	T	T	T	T

Chapter 1.4

7. Question 18:

- (a) 18(a): $P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2)$
(b) 18(f): $\neg(P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2))$

8. Question 24:

- (a) 24(a): $\forall xP(x)$, $\forall x(Q(x) \rightarrow P(x))$, $P(x) = x$ has a cell phone, $Q(x) = x$ is a student in your class
(b) 24(e): $\exists x\neg P(x)$, $\exists x\neg (Q(x) \wedge P(x))$, $P(x) = x$ wants to be rich, $Q(x) = x$ is a student in your class

9. Question 48:

- (a) 48(a):
i. $\forall xP(x) \vee A$ is true: A is true for all values of the variable not in statement, y, in which $P(y)$ is true. We can say that $P(y) \vee A$ is true for all differing values of y. That means that the RHS ($\forall xP(x) \vee A$) is false, just like the LHS.
ii. $\forall xP(x) \vee A$ is true: If A is true and some values result in the RHS and LHS as false. That means that it is not true for all values to be true.
iii. $\forall xP(x) \vee A$ is false: Both LHS and RHS are true since the conditional statement is true after the hypothesis is false.
(b) 48(b):
i. $\exists xP(x) \vee A$ is true: If A is true for every x, the LHS is the same as the RHS
ii. $\exists xP(x) \vee A$ is true: If A is true for some x, the LHS is the same as the RHS
iii. $\exists xP(x) \vee A$ is false: Both LHS and RHS are true since the conditional statement is true after the hypothesis is false.