HW #1, Part I Solutions SPRING 2024

Sec. 2.1

#6 Solution is in the back of the book.

#7 $m \wedge \sim c$

#8
a. In book.
b. $\sim w \wedge (h \wedge s)$
c. $\sim w \wedge \sim h \wedge \sim s$
d. In book
e. $w \wedge (\sim (h \wedge s))$

#12. In book

#15. $p \wedge (\sim q \vee r)$

p	q	r	$\sim q$	$\sim q \vee r$	$p \wedge (\sim q \vee r)$
T	T	T	F	T	T
T	T	F	F	F	F
T	F	T	T	T	T
T	F	F	T	T	T
F	T	T	F	T	F
F	T	F	F	F	F
F	F	T	F	T	F

Sec 2.1 (2)

#21 In book

#22

22.

p	q	r	$q \vee r$	$p \wedge q$	$p \wedge r$	$p \wedge (q \vee r)$	$(p \wedge q) \vee (p \wedge r)$
T	T	T	T	T	T	T	T
T	T	F	T	T	F	T	T
T	F	T	T	F	T	T	T
T	F	F	F	F	F	F	F
F	T	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	F	T	T	F	F	F	F
F	F	F	F	F	F	F	F

same truth values

The truth table shows that $p \wedge (q \vee r)$ and $(p \wedge q) \vee (p \wedge r)$ always have the same truth values. Therefore they are logically equivalent. This proves the distributive law for $\wedge$ over $\vee$.

#28 The units digit of 4^{67} is not 4 and it is not 6.

#29 This computer program does not have a logical error in the first ten lines AND it is not being run with an incomplete data set.

#30 The dollar is not at an all-time high OR the stock market is not at a record low.

Sec 2.1,

#33. "$-10 < x < 2$" means
"$-10 < x$ AND $x < 2$".

The negation is "$-10 \geq x$ OR $x \geq 2$",

That is to say "$x \leq -10$ OR $x \geq 2$",

#35. The Negation is "$x > -1$ AND $x \leq 1$",

that is to say, "$-1 < x \leq 1$".

#40. Answer is in the book

#42

42.

p	q	r	$\sim p$	$\sim q$	$\sim p \wedge q$	$q \wedge r$	$((\sim p \wedge q) \wedge (q \wedge r))$	$((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$
T	T	T	F	F	F	T	F	F
T	T	F	F	F	F	F	F	F
T	F	T	F	T	F	F	F	F
T	F	F	F	T	F	F	F	F
F	T	T	T	F	T	T	T	F
F	T	F	T	F	T	F	F	F
F	F	T	T	T	F	F	F	F
F	F	F	T	T	F	F	F	F

all F's

Since all the truth values of $((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$ are F, $((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$ is a contradiction.

Sec 2.1

#43

43.

p	q	$\sim p$	$\sim q$	$\sim p \vee q$	$p \wedge \sim q$	$(\sim p \vee q) \vee (p \wedge \sim q)$
T	T	F	F	T	F	T
T	F	F	T	F	T	T
F	T	T	F	T	F	T
F	F	T	T	T	F	T

all $T's$

Since all the truth values of $(\sim p \vee q) \vee (p \wedge \sim q)$ are T, $(\sim p \vee q) \vee (p \wedge \sim q)$ is a tautology.