Cody strange
1/27/2022

1.11.1(b): p ⇿ q
p ∨ q
∴ p

p	q	p ∨ q	p ↔ q
T	T	T	T
T	F	T	F
F	T	T	F
F	F	F	T

True

1.11.1(g):
q → p
¬q

∴ p

p	q	-p	q → p
T	T	F	T
T	F	F	T
F	T	T	F
F	F	T	T

False, p = F q=F

Cody strange
1/27/2022

1.11.3(c)

The patient has high blood pressure or diabetes or both.
The patient has diabetes or high cholesterol or both.

_____
∴ The patient has high blood pressure or high cholesterol.

P = The patent has high blood pressure, Q = The patient has diabetes, R = The patient has high cholesterol

P V Q
Q V R

_____
∴ P V R

P	Q	R	P V R	Q V R	P V R
T	T	T	T	T	T
T	T	F	T	T	T
T	F	T	T	T	T
T	F	F	T	F	T
F	T	T	T	T	T
F	T	F	F	T	F
F	F	T	T	T	T
F	F	F	F	F	F

True

1.12.1(a)
Sally had a side effect or Sally took the medication.
Sally took the medication.

_____
∴ Sally did not have side effects.

P = Sally had a side effect
Q = Sally took the medication

P V Q
Q

_____
∴ ¬P
Invalid, Sally had a side effect = T, Sally took the medication = T

Cody strange
1/27/2022

1.12.1(d)
If Sally had side effects, then she took the medication.
Sally did not take the medication.

_____
∴ Sally did not have side effects.

P = Sally had a side effect
Q = Sally took the medication

P → Q
¬Q

_____
∴ ¬P

Valid, modus tollens

1.12.2(f)
p → q
r → u
p ∧ r

_____
∴ q ∧ u

1. **p ∧ r, hypothesis**
2. **r, simplification 2**
3. **r → u, hypothesis**
4. **u, modus ponens 2&3**
5. **p → q, hypothesis**
6. **¬p V q, conditional identities 5**
7. **q, addition 6**
8. **q ∧ u, conjunction 4&7**

Cody strange
1/27/2022

1.12.4(a)

If I drive on the freeway, I will see the fire.
I will drive on the freeway or take surface streets (or both).
I am not going to take surface streets.
∴ I will see the fire.

p = drive on the freeway
q = see the fire
r = take surface streets

p → q
p V r
¬r

_____
∴ q

1. **p V r, hypothesis**
2. **p, addition 1**
3. **p → q, hypothesis**
4. **q, modus ponens 2&3**
5. **¬r, hypothesis**
6. **q, simplification 4&5**

1.13.1(a)
P(x) = practices hard
Q(x) = plays badly

∀x(P(x) V Q(x))
∃x(¬P(x))

_____
∴ Q(x)

1. **∀x(P(x) V Q(x)), hypothesis**
2. **∀xQ(x), addition 1**
3. **Q(x), Universal instantiation 2**
4. **∃x(¬P(x)), hypothesis**
5. **Q(x), simplification 3&4**

Cody strange
1/27/2022

1.13.5(a)
Every student on the honor roll received an A.
No student who got a detention received an A.

_____
No student who got a detention is on the honor roll.

P(x) = x was on the honor roll
Q(x) = x received an A
R(x) = x got detention

∀x(P(x) → Q(x))
∀x(R(x) → ¬Q(x))

_____
∴ ∀x(R(x) → ¬P(x))

Valid

1. **∀x(P(x) → Q(x)), hypothesis**
2. **P(x) → Q(x), Universal instantiation 1**
3. **¬P(x) V Q(x), conditional identities 2**
4. **∀x(R(x) → ¬Q(x)) , hypothesis**
5. **R(x) → ¬Q(x), Universal instantiation 4**
6. **¬R(x) V ¬Q(x), conditional identities 5**
7. **∀x(R(x) → ¬P(x)), hypothesis**
8. **R(x) → ¬P(x), Universal instantiation 7**
9. **¬R(x) V ¬P(x), conditional identities 8**
10. **¬R(x) V ¬P(x), Resolution 3&6**

1.13.5(c)
Every student who missed class got a detention.
Penelope is a student in the class.
Penelope got a detention.

_____
Penelope missed class.

P(x) = x missed classs
Q(x) = x got detention

Invalid
P(F)
P(T)