Submission 1.1

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0.1 1

Knaves always lie, knights always tell the truth, and in Transylvania, where everybody is one or the other (but you can't tell which by looking), you encounter two people, one of whom says, "He's a knight or I'm a knave." What are they?
A:He is a knight
B:I'm a knave
If the speaker is a knave, he's lying. In that case, if the other person was a knight, they would've called him a knave. Since the speaker calls the other person a knight and he can only do that when he isn't lying, the solution is that **both are knights.**

0.2 2-12

2. a.
   He must have gone to King's Pyland or to Mapleton.
   He is not at King's Pyland.
   —
   He is at Mapleton.

   b. Validity: Valid
   Soundness: Sound

   c.
   K: He's at King's Pyland
   M: He's at Mapleton

   $K \vee M$
   $\neg K$
   —
   M

   e.
   Proof (Contradiction):
   Assume there is a case in which the premises-$K \vee M$ and $\neg K$- are true

but the conclusion, M, is false. If ¬ K is true, K is false. But M (false)and K (false) implies K∨M is false. →← Thus no CE exists and argument is valid.

□

3. a.
The patient will die unless we operate.
We will operate.
—
The patient will not die.

b. Validity: Invalid
Soundness: Not Sound

c.
D: The patient will die
O: We will operate

¬ O ⇒ D
O
—
¬ D

d.

D	O	$\neg O \Rightarrow D$	O	$\neg D$
T	T	T	T	F
T	F	T	F	F
F	T	T	T	T
F	F	F	F	T

The first row proves that the argument is invalid because the premises are true and the conclusion is false.

e.
Proof (Conditional):
Consider the case in which D is true and O is true. In this case, both premises - $\neg O \Rightarrow D$ and O - are true but the conclusion, $\neg D$, is false. This is a CE and the argument is invalid.

□

4. a.
If I'm right, then I'm a fool.
If I'm a fool, I'm not right.
—

I'm no fool.

b. Validity: Invalid
Soundness: Not sound

c.
R: I'm right
F: I'm a fool

R ⇒ F
F ⇒ ¬ R
—
¬ F

e.
Proof (Conditional):
Consider the case in which F is true and R is false. In this case, both premises - $R \Rightarrow F$ and $F \Rightarrow \neg R$ - are true but the conclusion, $\neg F$, is false. This is a CE and the argument is invalid.

□

5. a.
If I'm right, then I'm a fool.
If I'm a fool, I'm not right.
—
I'm not right.

b. Validity: Valid
Soundness: Soundness hard to determine

c.
R: I'm right
F: I'm a fool

R ⇒ F
F ⇒ ¬ R
—
¬ R

d.

R	F	$R \Rightarrow F$	$F \Rightarrow \neg R$	$\neg R$
T	T	T	F	F
T	F	F	T	F
F	T	T	T	T
F	F	T	T	T

The third and fourth row proves that the argument is valid because the premises are true and the conclusion is true.

e.
Proof (Contradiction):
Assume there is a case in which the premises-$R \Rightarrow F$ and $F \Rightarrow \neg R$- are true but the conclusion, $\neg R$, is false. If $\neg R$ is false, R is true. If R is true, then F has to be true for the first premise -$R \Rightarrow F$- to be true. But F is true and $F \Rightarrow \neg R$ is true, implies $\neg R$ is true. $\rightarrow\leftarrow$ Thus no CE exists and argument is valid.

□

6. a.
If Einstein's theory of relativity is correct, light bends in the vicinity of the sun.
Light does indeed bend at the vicinity of the sun.
—
Einstein's theory of relativity is correct.

b. Validity: Invalid
Soundness: Not sound

c.
E: Einstein's theory of relativity is correct
L: Light bends in the vicinity of the sun

E ⇒ L
L
—
E

e.
Proof (Conditional):
Consider the case in which E is false and L is true. In this case, both premises - $E \Rightarrow L$ and L - are true but the conclusion, E, is false. This is a CE and the argument is invalid.

□

7. a.
Congress will agree to the cut only if the President announces his support first.
The President won't announce his support first
—

Congress won't agree to the cut.

b. Validity: Valid
Soundness: Soundness hard to determine

c.
C: Congress will agree to the cut
P: The President will announce his support first

C ⇒ P
¬ P
—
¬ C

d.

C	P	$C \Rightarrow P$	$\neg P$	$\neg$**C**
T	T	T	F	**F**
T	F	F	T	**F**
F	T	T	F	**T**
F	F	T	T	**T**

The fourth row proves that the argument is valid because the premises are true and the conclusion is true.

e.
Proof (Conditional):
Consider the case in which C is false and P is false. In this case, both premises - $C \Rightarrow P$ and $\neg P$ - are true. In order for the first premise to be true, C must be false so that the conclusion, $\neg C$, is true. Thus, no CE and the argument is valid.

□

8. a.
If you are ambitious, you'll never achieve all your goals.
Life has meaning only if you have ambition.
—
If you achieve all your goals, life has no meaning.

b. Validity: Valid
Soundness: Soundness hard to determine

c.
A: You are ambitious
G: You achieve all your goals
M: Life has meaning

A $\Rightarrow \neg$ G
A $\Rightarrow$ M
—
G $\Rightarrow \neg$ M

9. a.
If Adams wins the election, Brown will retire to private life.
If Brown dies before the election, Adams will win it.
—
If Brown dies before the election, he will retire to private life.

b. Validity: Valid
Soundness: Not sound

c.
A: Adam wins the election
B: Brown will retire to private life
D: Brown dies before the election

A $\Rightarrow$ B
D $\Rightarrow$ A
—
D $\Rightarrow$ B

d.

A	B	D	$A \Rightarrow B$	$D \Rightarrow A$	$D \Rightarrow B$
T	T	T	T	T	**T**
T	F	T	F	T	**F**
F	T	T	T	F	**T**
F	F	T	T	F	**F**
T	T	F	T	T	**T**
T	F	F	F	T	**T**
F	T	F	T	T	**T**
F	F	F	T	T	**T**

All the rows with premises that are true and the conclusions is true prove that the argument is valid.

10. a.
Either Holmes is right and the vile Moriarty is guilty or he is wrong and the scurrilous Thin did the job.

Those scoundrels are either both guilty or both innocent.
Holmes is right.
—

Thin is guilty.

b. Validity: Valid
Soundness: Soundness hard to determine

c.
H: Holmes is right
M: The vile Moriarty is guilty
D: The scurrilous Thin is guilty

(H $\wedge$ M) $\vee$ ($\neg$ H $\wedge$ D)
(M $\wedge$ D) $\vee$ ($\neg$ M $\wedge$ $\neg$ D)
H
—
D

11. a.
Mittens meows exactly when she is hungry.
Mittens is meowing, but she isn't hungry.
—
The end of the Earth is at hand.

b. Validity: Valid
Soundness: Not sound

c.
M: Mittens meows
H: She is hungry
E: The end of the Earth is at hand

H $\iff$ M
M $\wedge\neg$ H
—
E

d.

M	H	E	$H \iff M$	$M \wedge \neg H$	**E**
T	T	T	T	F	**T**
T	F	T	F	T	**T**
F	T	T	F	F	**T**
F	F	T	T	F	**T**
T	T	F	T	F	**F**
T	F	F	F	T	**F**
F	T	F	F	F	**F**
F	F	F	T	F	**F**

There is never a case where the premises can be true so the argument is valid.

12. a.
God is omnipotent if and only if He can do everything.
If He can't make a stone so heavy that He can't lift it, then he can't do everything.
If He can make a stone so heavy that He can't lift it, He can't do everything.
—
Either God is not omnipotent or God does not exist.

b. Validity: Valid
Soundness: Soundness hard to determine

c.
S: He can make a stone so heavy that He can't lift it
D: He can do everything
G: God is omnipotent
E: God exists

G $\iff$ D
$\neg$ S $\Rightarrow$ $\neg$ D
S $\Rightarrow$ $\neg$ D
—
$\neg$ G $\vee$ $\neg$ E

e.
Proof (Conditional):
Suppose the premises-G $\iff$ D,$\neg$ S $\Rightarrow$ $\neg$ D,S $\Rightarrow$ $\neg$ D-are true. Since $\neg$ S $\Rightarrow$ $\neg$ D and S $\Rightarrow$ $\neg$ D are true, $\neg D$ must be true, and D must be false. Since $G \iff D$ is true, G must be false. $\neg G$ is true so the conclusion $\neg G \vee \neg E$ will always be true. Therefore, the conclusion is always true when the premises are true and the argument is valid.

□

13.

1	2	3
4	X	6
7	8	9

1	2	3
O	X	6
7	8	9

1	2	3
O	X	6
X	8	9

1	2	O
O	X	6
X	8	9

1	X	O
O	X	6
X	8	9

1	X	O
O	X	6
X	O	9

X	X	O
O	X	6
X	O	9

X	X	O
O	X	6
X	O	O

A win isn't guaranteed from the cases shown above.

14. True because if an argument is valid, adding premises can't change it. If an argument is valid and adding a new true premise can't make a counterexample that makes the argument invalid.

15. True, even though you may remove premises, the counterexample still exists which prevents an invalid argument from becoming valid.

16. Suppose $(A \wedge B) \Rightarrow C$ is contingent. Since the sentence $(A \wedge B) \Rightarrow C$ isn't a tautology, it is false for two cases. Since this is a conditional, there is a case where C is false but A and B are true. In this case, the premises will be true but the conclusion false making the argument invalid.

17. If the argument is valid, the premises- A, B -and the conclusion- C -is true or A, B are contradictions and can never both be true. So when A, B, and C are true, $(A \wedge B) \Rightarrow C$ is true. If the premises are contradictions, then $(A \wedge B)$ is false, and $(A \wedge B) \Rightarrow C$ will still be true.

18. False, an argument with contradictory premises will be valid, no matter the conclusion. The condition of invalidity is defined as all the premises being true while the conclusion is false. The premises cannot all be true while the conclusion is false. Since the argument cannot be invalid, it must be valid.

19. False. Inconsistency means that not all sentences are true, there is always at least one that is false. So $A \wedge B \wedge C$ will always be false.

20. True. Since an argument with contradicting premises and a true conclusion is valid, the conclusion itself can be contradictory. For example,

premises can be “The sky is blue” and “The sky is black” and the conclusion could be “The sky is blue and black”. This is contradictory but valid.