2.5

I)

| P | Q | $P \wedge (P \to Q) \to Q$ |
|---|---|---|
| | | $t_4$ $T_2$ ? $t_5$ $F_3$ F $F_1$ |

II)

| $\neg Q \wedge (P \to Q) \to \neg P$ |
|---|
| $t_4$ $F_5$ $t_3$ ? $t_6$ $F_7$ F $F_1$ $t_2$ |

III)

| $P \vee \neg P$ |
|---|
| $F_1$ F $F_2$ ? |

IV)

| $\neg(P \wedge \neg P)$ |
|---|
| F $t_2$ $t_1$ $t_3$ ? |

V)

| $(\neg P \to P) \to P$ |
|---|
| $F_4$ ? $t_2$ $F_3$ F $F_1$ |

VI)

| $(P \to Q) \wedge (\neg P \to Q) \to Q$ |
|---|
| $F_7$ $t_3$ $F_6$ $t_2$ $F_8$ ? $t_4$ $F_5$ F $F_1$ |

VII)

| | $\neg(P \wedge Q) \leftrightarrow (\neg P \vee \neg Q)$ |
|---|---|
| 1 | $t_1$ ? $F_3$ $t_8$ F $F_4$ $t_6$ $F_2$ $F_5$ $t_7$ |
| 2 | $F_1$ $t_5$ $t_3$ $t_4$ F $F_7$ $t_6$ $t_2$ $t_8$ ? |

VIII)

| | $\neg(P \vee Q) \leftrightarrow (\neg P \wedge \neg Q)$ |
|---|---|
| 1 | $t_1$ $F_4$ $F_3$ $F_5$ F $t_7$ $F_6$ $\underline{F_2}$ $F_8$ ? |
| 2 | $\underline{F_1}$ ? $t_3$ $F_8$ F $t_4$ $F_6$ $\underline{t_2}$ $t_5$ $F_7$ |

IX)

| $P$ | $\wedge$ | $\neg P$ | $\rightarrow$ | $Q$ |
|---|---|---|---|---|
| $t_3$ | $t_2$ | $t_4$ ? | F | $F_1$ |

2.6

I)

| $P$ | $P \wedge P$ |
|---|---|
| F | $F_1$ F $F_2$ |
| t | $t_1$ t $t_2$ |

→ contingency

II

| Not necessary to evaluate | $P$ | $Q$ | $R$ | $((P \rightarrow Q) \rightarrow R) \leftrightarrow (P \rightarrow (Q \rightarrow R))$ |
|---|---|---|---|---|
| 1.1 | t | t | F | $t_9$ $t_4$ $t_{10}$ $\underline{F_1}$ $F_3$ t $F_7$ $\underline{F_2}$ $t_8$ $F_6$ $F_5$ |
| → 1.2 | | | | |
| 2.1 | | | | $F_8$ ? $\underline{t_1}$ $F_7$ F $t_3$ $\underline{F_2}$ $t_6$ $F_4$ $F_5$ |
| 2.21 | | | | |
| | | | | $t_9$ $t_4$ ? $\underline{F_1}$ $F_3$ F $\underline{t_6}$ $\underline{t_2}$ $F_8$ $\underline{t_7}$ $F_5$ |
| 2.22 | | | | |
| | F | F | F | $F_9$ $t_4$ $F_{10}$ $\underline{F_1}$ $F_3$ F $\underline{F_6}$ $\underline{t_2}$ $F_8$ $\underline{t_7}$ $F_5$ |

→ contingency

III) (I won't do a Partial Because I'll need to do a lot of assumptions)

| P | Q | R | $(P \leftrightarrow (Q \leftrightarrow R))$ | $\leftrightarrow$ | $((P \leftrightarrow Q) \leftrightarrow R)$ |
|---|---|---|---|---|---|
| T | T | T | T | T | T |
| T | T | F | F | T | T |
| T | F | T | F | T | F |
| T | F | F | T | T | F |
| F | T | T | F | T | F |
| F | T | F | T | T | F |
| F | F | T | F | T | T |
| F | F | F | T | T | T |

→ tautology

IV

| | P | Q | $\neg(P \to Q)$ | | | | $\leftrightarrow$ | $(P \wedge \neg Q)$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | T | F | $\underline{T_1}$ | $T_5$ | $F_3$ | $F_4$ | T | $T_6$ | $\underline{T_2}$ | $T_7$ | $F_8$ |
| 1.2 | | | | | | | | | | | |
| 2.1 | | | $\underline{T_1}$ | $T_5$ | $F_3$ | $F_4$ | F | $T_6$ | $\underline{F_2}$ | $F_7$ | ? |
| 2.2 | | | $\underline{F_1}$ | ? | $T_3$ | $F_2$ | F | $T_4$ | $\underline{T_2}$ | $T_5$ | $F_6$ |

→ tautology

2.7

III) $|\phi \vee \psi|_A = F$ iff $|\phi|_A = F$ and $|\psi|_A = F$

IV) $|\phi \rightarrow \psi|_A = F$ iff $|\phi|_A = t$ and $|\psi|_A = F$

V) $|\phi \leftrightarrow \psi|_A = F$ iff $|\varphi|_A \neq |\psi|_A$

2.8 According to definition 2.9 $I \models \phi$ iff there is no $L_1$-structure in which all sentences ~~are true~~ in $I$ are true and $\phi$ is false.

According to definition 2.11 a set of sentences is consistent iff there is an $L_1$-structure under which all sentences in the structure are true.

~~If~~ So, if a set is inconsistent there is no $L_1$-structure under which all sentences in that set are are true.

If the set containing all sentences $\neg I$ and $\neg\phi$ is inconsistent then there is no counterexample as in definition 2.10. therefore, the argument must be valid.

(3)

A: Jones arrives at the airport after the scheduled departure time

W: the plane will wait for Jones

N: nobody notices that

the argument being made is:

| $A \to W \therefore (A \wedge N) \to W$ |
|---|
| ? T $F_5$ $T_3$ $T_1$ $T_4$ F $F_2$ |

there is no counterexample so the argument seems valid. However, you could argue that the plane will of course only wait for Jones if they know that he is late (i.e. I am implicitly assuming), so you could argue that the argument should actually be formalised the following way:

| $(A \wedge \neg N) \to W \therefore (A \wedge N) \to W$ |
|---|
| $T_5$ $F_8$ $F_7$ $T_6$ T $F_9$ $T_3$ $T_2$ $T_4$ F $F_1$ |

so in this case there is a counterexample and so the argument is not valid.

this, however, does not have to be the case, there could be some other mechanism that will cause the plane to wait which does not require anyone to know that Jones is late. So, in my opinion we should apply the principle of charity and assume the latter.

33

I)

| A | Robin believes that A |
|---|---|
| t | ? |
| F | ? |

II)

| A | Robin knows that A |
|---|---|
| t | ? |
| F | F → however, this depends on your definition of what it means to know something |

III)

| A | Robin knows that A, But it's not true that A |
|---|---|
| t | F → this is false because we just said that if something is not true, one cannot know it |
| F | F |

Could be done as

| A | (Robin knows that A ∧ ¬A) |
|---|---|
| t | ? t F F t |
| F | F F F t F |

~~How can we get different results? that is because in this case, Robin would never believe A if A is false so both statements can't be true at the same time.~~

~~You could argue here that there should not be a question mark because the event of A being true there is a contradiction because~~

It is a contradiction, Robin would never believe A if A is false so both statements can't be true at the same time.

III)

| A | the infallible clairvoyant believes that A |
|---|---|
| T | ? |
| F | F |

this depends on the definition of "believing" though. If you say that it is impossible to believe something without having thought about it, the first row becomes a "?".

IV)

| A | B | A, but B |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

(same as ∧)

VI

| A | B | Suppose A; then B |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | ? |

it could be a counterfactual, so this one could be both

~~VI)~~

| A | B | Suppose A; then B |
|---|---|---|
| T | T | ? ~~T~~ |
| T | F | ? ~~F~~ ~~F~~ |
| F | T | ? ~~T~~ ~~T~~ |
| F | F | ? ~~T~~ ~~T~~ |

(~~same~~ same as →)

~~because the hypothetical world is based on reality. Suppose the sky is fully black then you could still see the sun.~~

3.6

S : Many students will be in Schopenhauer's lectures

H : " " Hegel's "

t : they are scheduled at the same time

$E_1$ : Hegel's lectures are entertaining

$E_2$ : Schopenhauer's "

Initially you'd think it is formalised like this:

$$t \to (H \vee S),\ t,\ E_1 \to H,\ E_2 \to E_1,\ S \to E_2 \ \therefore\ H \wedge \neg S$$

| S H t $E_1$ $E_2$ | $t \to (H \vee S)$ | $t$ | $E_1 \to H$ | $E_2 \to E_1$ | $S \to E_2$ | $H \wedge \neg S$ |
|---|---|---|---|---|---|---|
| 1 F T T T T | $t_1$ T $\underline{t_3}$ $t_2$ $\underline{t_4}$ | T | $t_{13}$ T $t_5$ | $t_{11}$ T $t_{12}$ | $t_6$ T $t_7$ | $t_8$ F $F_{10}$ $t_9$ |

So there is a counterexample,

so

However, "many students come to schopenhauers lectures or Hegel's lectures" could be interpreted as an exclusive or, that there could not be many students in both lectures:

| | $t$ | $\rightarrow$ | $((H \vee S) \wedge \neg(H \wedge S))$ | $t$ | $E_1 \rightarrow H$ | $E_2 \rightarrow E_1$ | $S \rightarrow E_2$ | $H \wedge \neg S$ |
|---|---|---|---|---|---|---|---|---|
| 1 | $t_1$ | $t$ | $\underline{t_6}\ t_3\ \underline{F_7}\ t_2\ t_4\ \underline{t_8}\ F_5\ \underline{F_9}$ | $t$ | $t\ t_{10}$ | $t$ | $F_{11}\ t\ t_{12}$ | $F\ F_{13}$ ? |
| 2 | $t_1$ | $t$ | $\underline{F_6}\ t_3\ \underline{t_7}\ t_2\ t_4\ \underline{F_8}\ F_5\ \underline{t_9}$ | $2$ | $F_{11}\ t\ F_{10}$ | $F_{13}\ t\ F_{12}$ | ? $t\ F_{13}$ | $F$ |

You only have to check these two because there are only two ways for an XOR to be true. So there are no counterexamples, so the assumption makes the argument valid