24.141 PSet 2

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Collaborators

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Q1

"ψ" is a sentence letter by itself and can be inferred as just what it evaluates to.
$\ulcorner\neg\psi\urcorner$ is multiple sentence letters, so we have to use corner quotes to emphasize that we want the value of the sentence letters as an expression, not the raw letters.

Q2

"Sam is flying to Europe" is a sentence and is an expression.
"Sam" is "flying to Europe is a sentence" and is an expression.
"Sam" is "flying to Europe is a sentence and is an expression".

Q3

A

$\phi \vee \psi := \neg(\neg\phi \wedge \neg\psi)$

B

$\phi \rightarrow \psi := \neg(\phi \wedge \neg\psi)$

C

$\phi \leftrightarrow \psi := \neg(\neg(\phi \wedge \psi) \wedge \neg(\neg\phi \wedge \neg\psi))$

Q4

A

ϕ	ψ	$\phi \uparrow \psi$
0	0	1
0	1	1
1	0	1
1	1	0

B

$\phi \wedge \psi := (\phi \uparrow \psi) \uparrow (\phi \uparrow \psi)$
$\neg\phi := \phi \uparrow \phi$

C

This operator is non-homophonic and also a strange truth table. Also, on top of that, writing some operations feels quite redundant like $\phi \uparrow \phi$ to get a negation. This would just make it a headache to work with, making sentences longer and less intuitive to understand their meaning.

Q5

A

$V_I(\varphi \vee \psi) = V_I(\varphi) + V_I(\psi)$
$V_I(\varphi \rightarrow \psi) = 1 - (V_I(\varphi) \times (1 - V_I(\psi)))$
$V_I(\varphi \vee \psi) = (V_I(\varphi) \times V_I(\psi)) + ((1 - V_I(\varphi)) \times (1 - V_I(\psi)))$

B

Since the semantics above are derived from homophonic operators, then they can be decomposed to homophonic operators by substitution and are therefore homophonic in disguise.