

Assignment #2-key.

1a)	P	$\neg(\neg P \wedge \neg P)$	P
	T	T	T
	F	F	F

The wffs are truth-functionally equivalent.

1b)	P	Q	R	$((P \vee Q) \wedge R)$	$(P \vee (Q \wedge R))$
	T	T	T	T	T
	T	T	F	F	T
	T	F	T	T	T
	T	F	F	F	T
	F	T	T	T	T
	F	T	F	F	F
	F	F	T	F	F
	F	F	F	F	F

The wffs are not truth-functionally equivalent. The valuations in rows 2, 4 assign them different truth values.

1c)	P	$(P \vee \neg P)$	$\neg P$
	T	T	F
	F	T	T

The wffs are not truth-functionally equivalent. The valuations in rows 1, 2 assign them different truth values.

2. Construct a wff in **PL** that is truth-functionally equivalent to the truth function $\#(P, Q, R)$ given by the following truth-table:

P	Q	R	$\#(P, Q, R)$
T	T	T	F
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

First: Construct the basic conjunction that corresponds to each valuation that makes $\#(P, Q, R)$ true.Row 2: $(P \wedge Q \wedge \neg R)$ Row 3: $(P \wedge \neg Q \wedge R)$ Row 4: $(P \wedge \neg Q \wedge \neg R)$ Second: Form the disjunction of all these basic conjunctions:

$$((P \wedge Q \wedge \neg R) \vee (P \wedge \neg Q \wedge R) \vee (P \wedge \neg Q \wedge \neg R))$$

Note: This wff is true so long as any of its disjuncts (components) are true, which is the case in Rows 2, 3, 4. For any other row, none of the basic conjunctions are true, so the disjunction will be false.

3a)	P	Q	premise1 $(\neg P \wedge Q)$	conclusion $\neg(P \wedge Q)$
	T	T	F	F
	T	F	F	T
	F	T	T	T
	F	F	F	T

There is no row (valuation) that makes the premise true and the conclusion false. So the **PL** argument is tautologically valid.

3b)

P	Q	premise1		premise2	conclusion
		P	$\neg P$		
T	T	T	F	T	
T	F	T	F	F	
F	T	F	T	T	
F	F	F	T	F	

There is no valuation that makes the premises true and the conclusion false. So the **PL** argument is tautologically valid.

3c)

P	Q	R	premise1	premise2	premise3	conclusion
			$(Q \vee \neg P)$	$\neg Q \wedge \neg R$	$(\neg R \vee \neg P)$	$\neg P$
T	T	T	T	T	F	F
T	T	F	T	F		F
T	F	T	F			F
T	F	F	F			F
F	T	T				T
F	T	F				T
F	F	T				T
F	F	F				T

In all valuations in which the conclusion is false, at least one premise is false. So there are no valuations that make all premises true and the conclusion false. So the **PL** argument is tautologically valid.