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Program Verification
Quiz 1

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1.

a) An interpretation is a mapping of propositional variables to truth values.
Eg. $I = \{p:1, q:0, r:1\}$

b) Valuations take an interpretation and a propositional formula and assigns a truth value to the formula according to the interpretation.
Eg. $A = p \vee (\neg q \wedge r)$
$Val(I, A) = 1$ (true)

c) Tautology is a formula that evaluates to true regardless of the interpretation
Eg. $p \vee \neg p$

d) Consider two formulas A_1, A_2
$A_1 \equiv A_2$ if and only if
$Val(I, A_1) = Val(I, A_2)$
for all interpretations I.
Eg. $\neg(p \vee q) \equiv \neg p \wedge \neg q$

2. Proof:

1.

1.1	$(P \to q) \land (\neg r \to \neg q)$	Assumed
1.1.1	P	Assumed
~~1.1.2~~	~~P~~	~~1.1.1, $\land E_1$~~
1.1.3	$P \to q$	1.1, $\land E_1$
1.1.4	q	1.1.1, 1.1.3, $\to E$
1.1.5	$\neg r \to \neg q$	1.1, $\land E_2$
1.1.5.1	$\neg q$	Assumed
1.1.5.2	$\bot$	1.1.4, 1.1.5.1, $\neg E$
1.1.6	r	1.1.5.2, RAA
1.2	$P \to r$	1.1.1, 1.1.6 $\to I$
2	$(P \to q) \land (\neg r \to \neg q) \to (P \to r)$	1.1, 1.2 $\to I$

3. rewriting $[(p \to q) \wedge [\neg r \to \neg q)] \to (p \to r)$ to a logically equivalent formula using $a \to b \equiv \neg a \vee b$

$\neg[(\neg p \vee q) \wedge (r \vee \neg q)] \vee (\neg p \vee r)$