

CSE 390Z: Mathematics for Computation Workshop

QuickCheck: Equivalences Solutions

Please submit a response to the following questions on Gradescope. We do not grade on accuracy, so please submit your best attempt. You may either typeset your responses or hand-write them. Note that hand-written solutions must be legible to be graded.

We have created [this template](#) if you choose to typeset with Latex. [This guide](#) has specific information about scanning and uploading pdf files to Gradescope.

0. Equivalences

Consider the proposition $(p \rightarrow q) \vee \neg(q \wedge \neg p)$.

(a) Use a truth table to show that the proposition is a tautology.

Solution:

p	q	$p \rightarrow q$	$\neg p$	$q \wedge \neg p$	$\neg(q \wedge \neg p)$	$(p \rightarrow q) \vee \neg(q \wedge \neg p)$
T	T	T	F	F	T	T
T	F	F	F	F	T	T
F	T	T	T	T	F	T
F	F	T	T	F	T	T

(b) Use a chain of equivalences to show that the proposition is a tautology.

Solution:

$$\begin{aligned} (p \rightarrow q) \vee \neg(q \wedge \neg p) &\equiv (\neg p \vee q) \vee \neg(q \wedge \neg p) && \text{Law of Implication} \\ &\equiv (\neg p \vee q) \vee (\neg q \vee \neg\neg p) && \text{DeMorgan's Law} \\ &\equiv (\neg p \vee q) \vee (\neg q \vee p) && \text{Double Negation} \\ &\equiv ((\neg p \vee q) \vee \neg q) \vee p && \text{Associativity} \\ &\equiv (\neg p \vee (q \vee \neg q)) \vee p && \text{Associativity} \\ &\equiv (\neg p \vee T) \vee p && \text{Negation} \\ &\equiv T \vee p && \text{Domination} \\ &\equiv p \vee T && \text{Commutativity} \\ &\equiv T && \text{Domination} \end{aligned}$$

1. Video Solution

Watch [this video](#) on the solution **after** making an initial attempt. Then, answer the following questions.

- (a) What is one thing you took away from the video solution?
- (b) What topic from the quick check or lecture would you most like to review in workshop?