

Homework 2

September 23, 2019



Deadline

Due: September 30, 2019, 23:59. Good luck!

Problem 1

Formalize the following statement with connectives and propositional variables. (Hint : p10 in the textbook)

Tom is a blue cat or Tom is a black cat.

Solution.

Your solution here.

Problem 2

If a connective connects n propositional variables, how many different connectives can we define? Given a well-formed formula with n propositional variables, how many rows if we build the truth table?

Solution.

Your solution here.

Problem 3

We define a new connective $\downarrow$:

$$P \downarrow Q = \neg(P \vee Q)$$

Please use only $\downarrow$ to represent $\neg, \wedge, \vee, \rightarrow, \leftrightarrow$. You need to write the intermediate steps instead of only writing the final expression.

Solution.

Your solution here.

Problem 4

Write the formula of A according to T rows. Write the formula of B according to F rows.

P	Q	A	B
T	T	F	T
T	F	T	T
F	T	T	F
F	F	T	F

Solution.

Your solution here.

Problem 5

Prove the following equations with laws. Don't use truth table.

- $(P \rightarrow Q) \wedge P = P \wedge Q$
- $\neg(P \leftrightarrow Q) = (P \wedge \neg Q) \vee (\neg P \wedge Q)$
- $(P \vee Q) \leftrightarrow (P \wedge Q) = (P \wedge Q) \vee (\neg P \wedge \neg Q)$

Solution.

Your solution here.

Problem 6

Determine if $(P \leftrightarrow Q) \leftrightarrow ((P \wedge \neg Q) \vee (Q \wedge \neg P))$ is a tautology, a contradiction or a satisfiable formula. You should use two ways to solve the problem – building a truth table and using laws to convert the formula.

Solution.

Your solution here.