

HOMEWORK 1  
MATH 3345 – SPRING 2022 – KUTLER

Please complete the following problems on your own paper. Solutions should be written clearly, legibly, and with appropriate style.

1. **[Falkner Section 2 Exercise 1]** Let  $P$  and  $Q$  be logical sentences. Prove the second DeMorgan Law

$$\neg(P \vee Q) \text{ is logically equivalent to } \neg P \wedge \neg Q$$

in two ways:

- (a) By means of a truth table;
  - (b) By means of an explanation in words.
2. Let  $P$ ,  $Q$ , and  $R$  be logical sentences. Show by means of a truth table that the sentence  $P \wedge (Q \vee R)$  is not logically equivalent to the sentence  $(P \wedge Q) \vee R$ .

**Practice Problems**

It is strongly recommended that you complete the following problems. Do not submit your solutions.

1. Explain why the sentence

“This sentence is false.”

is not a logical sentence.

2. For each sentence below, describe (in interval notation) the set of real numbers  $x$  for which the sentence is true.

(a)  $(x > 1) \wedge (x < 3)$

(b)  $(x > 1) \vee (x < 3)$

(c)  $\neg((x > 1) \wedge (x < 3))$

(d)  $(\neg((x > 1) \wedge (x < 3))) \vee ((x < 2) \wedge (x > 1))$ .

For example, the sentence  $(x \geq 0) \wedge (x < 5)$  is true for exactly the real numbers  $x$  in the half-open interval  $[0, 5)$ .

You may have to write your answer as a union of intervals.