

# MH1812 Tutorial

## Chapter 2: Propositional Logic

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Q1: Decide whether the following statements are propositions. Justify your answer.

1.  $2+2 = 5$ .
2.  $2+2 = 4$ .
3.  $x = 3$ .
4. Every week has a Sunday.
5. Have you read “Catch 22” ?

Q2: Show that

$$\neg(p \vee q) \equiv \neg p \wedge \neg q.$$

This is the second law of De Morgan.

Q3: Show that second absorption law  $p \wedge (p \vee q) \equiv p$  holds.

Q4: These two laws are called distributivity laws. Show that they hold:

1. Show that  $(p \wedge q) \vee r \equiv (p \vee r) \wedge (q \vee r)$ .
2. Show that  $(p \vee q) \wedge r \equiv (p \wedge r) \vee (q \wedge r)$ .

Q5: Verify  $\neg(p \vee \neg q) \vee (\neg p \wedge \neg q) \equiv \neg p$  by

- constructing a truth table,
- developing a series of logical equivalences.

Q6: Using a truth table, show that:

$$\neg q \rightarrow \neg p \equiv p \rightarrow q.$$

Q7: Show that  $p \vee q \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$ .

Q8: Are  $(p \rightarrow q) \vee (q \rightarrow r)$  and  $p \rightarrow r$  equivalent statements ?

Q9: Show that this argument is valid:

$$\neg p \rightarrow F; \therefore p.$$

Q10: Show that this argument is valid, where  $C$  denotes a contradiction.

$$\neg p \rightarrow C; \therefore p.$$

Q11: Determine whether the following argument is valid:

$$\begin{aligned} &\neg p \rightarrow r \wedge \neg s \\ &t \rightarrow s \\ &u \rightarrow \neg p \\ &\neg w \\ &u \vee w \\ &\therefore t \rightarrow w. \end{aligned}$$

Q12: Determine whether the following argument is valid:

$$\begin{aligned} &p \\ &p \vee q \\ &q \rightarrow (r \rightarrow s) \\ &t \rightarrow r \\ &\therefore \neg s \rightarrow \neg t. \end{aligned}$$