

MA0301
ELEMENTARY DISCRETE MATHEMATICS
NTNU, SPRING 2021

SET 1

Deadline: Wednesday 27 January, 2021, 13:00.

Exercise 1. Let p, q be propositional variables for which the implication $p \Rightarrow q$ is false. Determine the truth value for each of the following.

$$a) p \wedge q \quad b) \neg p \vee q \quad c) q \Rightarrow p \quad d) \neg q \Rightarrow \neg p$$

Exercise 2. Let p, q, r denote the following statements about a particular triangle ABC .

- p : Triangle ABC is isosceles.
- q : Triangle ABC is equilateral.
- r : Triangle ABC is equiangular.

Translate each of the following into an English sentence.

$$a) q \Rightarrow p \quad b) \neg p \Rightarrow \neg q \quad c) q \Leftrightarrow r \quad d) p \wedge \neg q \quad e) r \Rightarrow p$$

Exercise 3. Construct a truth table for each of the following compound statements, where p, q, r denote propositional variables.

$$a) \neg(p \wedge \neg q) \Rightarrow \neg p \quad b) p \Rightarrow (q \Rightarrow r)$$

Exercise 4. Using truth tables, verify if the following compound statements are tautologies.

$$a) q \Leftrightarrow (\neg p \vee \neg q) \quad b) [(p \Rightarrow q) \wedge (q \Rightarrow r)] \Rightarrow (p \Rightarrow r)$$

Exercise 5. If the statement q has the truth value T , determine all truth value assignments for the propositional variables, p, r and s for which the truth value of the statement

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

is T .

Exercise 6. Let p, q, r be propositional variables. Use truth tables to verify the following logical equivalences.

$$a) [p \Rightarrow (q \wedge r)] \equiv [(p \Rightarrow q) \wedge (p \Rightarrow r)] \quad b) [p \Rightarrow (q \vee r)] \equiv [\neg r \Rightarrow (p \Rightarrow q)]$$

Exercise 7. Negate each of the following and simplify the resulting statement.

$$a) (p \wedge q) \Rightarrow r \quad b) p \Rightarrow (\neg q \wedge r)$$

Exercise 8. Lewis, Zax: Exercise 9.3.

Exercise 9. Lewis, Zax: Exercise 9.5.

Exercise 10. Lewis, Zax: Exercise 9.6 a.