MA0301
ELEMENTARY DISCRETE MATHEMATICS
NTNU, SPRING 2022

SET 1

Deadline: Monday 24.01.2022, 11:59 pm

Exercise 1. *Write out the truth table for the following compound statements:*

$$a)p \Rightarrow (q \vee r) \quad b)r \Rightarrow (p \Rightarrow q) \quad c)p \Rightarrow (q \Rightarrow \neg r) \vee (p \oplus r)$$

Can you make the statements in a) and b) logically equivalent by just adding one single negation?

Exercise 2. *Let p, q and r be propositional variables. Verify whether the following compound statements are satisfiable, tautologies or unsatisfiable. Hint: You may use truth tables but it is also possible to use shorter arguments in sentences.*

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

Exercise 3. *Let $a, b, c \in \mathbb{R}$ denote real numbers and consider the following statements about them*

(1) *p: a is smaller than b.*
(2) *q: b is smaller than c.*
(3) *r: a is smaller than c.*
(4) *s: a is equal to b.*
(5) *t: b is equal to c.*
(6) *u: a is equal to c.*

Translate the following into an English sentence and comment on whether they should be reasonable statements about real numbers.

$$a)p \wedge q \Rightarrow r \quad b)p \wedge q \Rightarrow u \quad c)(p \vee s) \wedge (q \vee t) \wedge u \Rightarrow s$$

Exercise 4. *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*

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

is T.

Exercise 5. *Negate each of the following and simplify the resulting statement*

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

Exercise 6. *Lewis, Zax: Exercise 9.3*

Exercise 7. *Lewis, Zax: Exercise 9.5*

Exercise 8. *Lewis, Zax: Exercise 9.6 a.*

Date: January 14, 2022.