TMA4140
DISKRET MATEMATIKK – DISCRETE MATHEMATICS
NTNU, HØST/FALL2020

EXERCISE SET 7 / ØVING 7

The solutions must be submitted via OVSYS (to the assigned group/TA).
Løsningene må sendes inn via OVSYS (til den tildelte gruppen/TA).

Deadline for submission: **Friday, 16 October, 4:00pm**
Innleveringsfrist: **Fredag, 16. Oktober, kl. 16:00**

Textbook: K. H. Rosen, *Discrete Mathematics and Its Applications*, 8. edition

Exercise/Oppgave

1. *Let A, B, C be sets. Consider relations $X \subseteq A \times B$ and $Y \subseteq B \times C$. We define the composition of relations X and Y as the relation $Y \circ X \subseteq A \times C$ consisting of ordered pairs (a, c), for which there exists an element $b \in B$ such that $(a, b) \in X$ and $(b, c) \in Y$.*

We define for a relation $W \subseteq A \times B$ the inverse relation $W^{-1} := \{(b, a) \mid (a, b) \in W\} \subseteq B \times A$.

Consider the relations $R, S \subset \mathbb{N} \times \mathbb{N}$ defined by:

$$R = \{(0,2), (0,5), (0,9), (1,9), (1,12), (1,15), (2,2)\}$$

$$S = \{(2,0), (2,6), (5,6), (9,8), (12,1), (12,7), (15,4)\}.$$

Determine R^{-1}, S^{-1} and $(S \circ R)^{-1}$ and deduce a connection between the three relations?

Exercise/Oppgave

2. *Let U be the universe. For the set $S \subset U$ we define the characteristic function $f_S : U \to \{0, 1\}$ by $f_S(x) := 1$ if $x \in S$ and $f_S(x) := 0$ otherwise. Now, let A and B be two sets in U. Show that $\forall x \in U$: $f_{A \cup B} = f_A(x) + f_B(x) - (f_A f_B)(x)$.*

Exercise/Oppgave

3. *A car dealership has 30 cars. 20 cars have radios, 8 cars have air conditioners and 25 cars have fuel injection. Note: 20 have at least two of these features and 6 have all three.*

a) How may cars have at least one of the features?

b) How many have none of these features?

c) How many have exactly one?

Date: October 3, 2020.

Exercise/Oppgave
4. Section/Sektion 6.1: *27, 46*

Exercise/Oppgave
5. Section/Sektion 6.2: *18, 20*

Exercise/Oppgave
6. Section/Sektion 6.3: *19a,b,c, 20*

Exercise/Oppgave
7. Section/Sektion 6.5: *12, 14, 32, 56*

Exercise/Oppgave
8. Section/Sektion 6.6: *5*

Exercise/Oppgave
9. Section/Sektion 8.1: *11, 20*

Exercise/Oppgave
10. Section/Sektion 8.2: *3c,d,e,g, 6, 11, 42*