MA0301 ELEMENTARY DISCRETE MATHEMATICS
NTNU, SPRING 2018

1. Homework Set 5

Exercise 1. (Grimaldi, 5. ed., Exercises 4.1, page 208) *Exercise 1 a), b), c)*

Exercise 2. *Let* $Y := \{1, 2, 3, 4, \ldots, 600\}$. *Use the inclusion-exclusion principle to find the numbers of positive integers in* Y *that are not divisibile by* 3 *or* 5 *or* 7.

Exercise 3. *Use the principle of induction to show that for all natural numbers* n, $4\sum_{i=1}^{n} i(i+2)(i+4) = n(n+1)(n+4)(n+5)$.

Exercise 4. (Grimaldi, 5. ed., Exercises 4.1, page 208) *Exercise 12*

Exercise 5. (Grimaldi, 5. ed., Exercises 4.1, page 209) *Exercise 16*

Exercise 6. (Grimaldi, 5. ed., Exercises 4.1, page 209) *Exercise 17*

Exercise 7. *Use the laws of set theory to show for arbitrary sets* A, B, C *that:*

(1) If $(A \cup B) \subseteq (A \cap B)$ then $A = B$.
(2) $\overline{A \cap B} = \overline{A} \cup \overline{B}$.
(3) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

2. Classroom Set 5

Exercise 8. (Grimaldi, 5. ed., Exercises 4.1, page 208) *Exercise 2*

Exercise 9. *Use the principle of induction to show that for all* $n \in \mathbb{Z}^+$, $\sum_{i=1}^{n} i^3 = (\frac{n(n+1)}{2})^2$.

Exercise 10. *Use the principle of induction to show that for all* $n \in \mathbb{Z}^+$, $n^3 + 3n^2 + 2n$ *is a multiple of* 6.

Exercise 11. (Grimaldi, 5. ed., Exercises 4.1, page 209) *Exercise 19*

Exercise 12. (Grimaldi, 5. ed., Exercises 4.1, page 210) *Exercise 27*

Exercise 13. *Let*

$$C := \{n \in \mathbb{N} \mid n \text{ is a multiple of } 12\}$$

and

$$D := \{n \in \mathbb{N} \mid n \text{ is a multiple of } 2 \text{ and } n \text{ is a multiple of } 6\}.$$

Which of the statements is true: $C \subseteq D$, $D \subseteq C$, $C = D$.

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Exercise 14. *By using rules of inference, show that the following arguments are true:*

$$i)\ \neg(a \wedge b) \wedge (\neg c \to b) \to (a \to c)$$

$$ii)\ \neg(\neg p \vee q) \wedge (\neg z \to \neg s) \wedge ((p \wedge \neg q) \to s) \wedge (\neg z \vee r) \to r$$