Homework #1. Due on Friday, January 26th by 1pm in TA's mailbox

Reading:

1. For this assignment: sections 1.1 and 1.2 of the BOOK (throughout this assignment BOOK refers to the book 'A discrete transition to advanced mathematics').
2. For next week's classes: sections 1.1-1.4 of the BOOK.

Practice problems from the BOOK: From 1.1: 1, 3, 5, 6, 8. From 1.2: 1, 2(a)(c)(e)(g)(i)(k), 4(a)(b), 5(a)(c)(e)(g)(i).

Problems to hand in:

1. Problem 4 in 1.1 from the BOOK.

2. Problem 2 in 1.2(b)(d)(f)(h)(j)(l) from the BOOK.

3. Let A and B be subsets of the universal set U. Prove that $A \setminus B = A \cap B^c$.

4. Let A, B and C be arbitrary sets. Prove each of the following identities in two ways: by drawing the Venn diagram and by using the true-false table:

(a) $(A \cap B)^c = A^c \cup B^c$

(b) $(A \setminus B) \cup (B \setminus A) = (A \cup B) \setminus (A \cap B)$. The common value of both sides of this equality is called the *symmetric difference of* A *and* B and is usually denoted by $A \triangle B$.

(c) (practice) $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

(d) $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

5. Let A, B and C be subsets of the universal set U. Prove the identity

$$A \setminus (B \setminus C) = (A \cap B^c) \cup (A \cap C)$$

without drawing a Venn diagram or computing the true-false table but instead using the identities from problems 3 and 4.

6. In Lecture 2 we will prove that $|A \cup B| = |A| + |B| - |A \cap B|$ for any finite sets A and B (this is also Theorem 1.2.1(a) from the BOOK). Use this result and a suitable part of Problem 4 to prove that

$$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C|$$

for any finite sets A, B and C.

7. Problem 4(c)(d)(e) in 1.2 from the BOOK. Make sure to justify your answer.