## Homework #2. Due on Friday, February 2nd by 1pm in TA's mailbox Reading:

1. For this assignment: sections 1.3 and 1.4 of the BOOK (throughout this assignment BOOK refers to the book 'A discrete transition to advanced mathematics').

2. For next week's classes: sections 1.5, 1.6 and beginning of 2.1 of the BOOK (I am not sure if we will get to 2.1).

Practice problems from the BOOK: From 1.3: 3, 5, 8, 9(a)(c), 11. From 1.4: 1, 2(a)(c)(e)(g), 3(a)(c), 7, 10, 12, 14.

## Problems to hand in:

1. List all the partitions of the set  $\{1, 2, 3, 4, 5\}$  which do not have any 1-element blocks.

**2.** Problem 7 in 1.3 from the BOOK.

3. Problem 1 in 1.3 from the BOOK. Justify your answer.

**4.** Let A and B be sets. Let  $\{A_i \mid i \in I\}$  be a partition of A and let  $\{B_j \mid j \in J\}$  be a partition of B. For each  $(i, j) \in I \times J$  let  $C_{(i,j)} = A_i \times B_j$ , and let  $\mathcal{C} = \{C_{(i,j)} \mid (i, j) \in I \times J\}$ . Thus,  $\mathcal{C}$  is a collection of sets indexed by  $I \times J$ . Prove that  $\mathcal{C}$  is a partition of  $A \times B$ .

**5.** Problem 9(b)(d) in 1.3 from the BOOK. Note that the definition of a *refinement* can be rephrased as follows. Let  $C = \{C_i \mid i \in I\}$  and  $D = \{D_j \mid j \in J\}$  be partitions of the same set. Then C is a refinement of D if every block of C is contained in some block of D, that is, for every  $i \in I$  there exists  $j \in J$  such that  $C_i \subseteq D_j$ . Justify your answer.

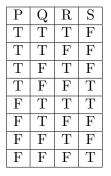
**6.** Problem 2(b)(d)(f) in 1.4 from the BOOK. Your statements should avoid expression like "it is not true that ..." or "it is false that ..."

7. Solve problem 6 in 1.4 from the BOOK using truth tables (here A, B and C are arbitrary statements).

8. Solve problem 13 in 1.4 from the BOOK using just De Morgan and distributive laws (do not compute the truth tables).

**9.** Let P, Q and R be statements.

(a) Find a statement S obtained from P, Q and R using negation, conjunction and disjunction (possibly several times) whose truth value is given by the following table:



(b) Now let U be any statement whose truth value is completely determined once the truth values of P, Q and R are now. Prove that there exists a statement V obtained from P, Q and R using negation, conjunction and disjunction such that V and U are equivalent statements.