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 $\mathcal{C} = \{C_i \mid i \in I\}$ and $\mathcal{D} = \{D_j \mid j \in J\}$ be partitions of the same set. Then $\mathcal{C}$ is a refinement of $\mathcal{D}$ 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:

P	Q	R	S
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	T
F	T	T	T
F	T	F	F
F	F	T	F
F	F	F	T

(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.