First set of obligatory assignments for DM528 Fall 2010*

November 12, 2010

It is allowed (and strongly encouraged!) to work in groups of up to 3 and hand in one report per group. **Different groups are NOT allowed to collaborate!** Your reports must be handed in to the instructor Magnus Find on Wednesday December 1st. Magnus will return the corrected reports on December 8th. Approval of your report will depend on how well you answer the problems. It is not necessary to answer everything correctly in order to pass, but it must be clear that you have worked seriously on each problem and come up with a number of relevant ideas and partial solutions. In case your solution is not approved, but could be approved with a bit more work, we may decide to give you the opportunity for a quick redo and then return a couple of days later for the final verdict. **It is completely up to us whether we will use that possibility and it will only be an exception, so don't count on getting a few more days to do the problems!**

Remember: the more work you do on this and the second obligatory assignment, the easier passing the final exam will be for you!

For each of the problems you should explain what you do and which methods/results from the book you use or argue directly why your solution is correct.

*Recall that it is required to have both this and the second obligatory assignment approved in order to attend the written exam in January.

Solve the following problems (the previous exam problems are available from the course page):

1. Suppose we are given a group of people each of which has read one of more of the four different books q_i, $i = 1, 2, 3, 4$. Assume also that we do not know in advance which books a given person has read.

   - Suppose (for this and the next subquestion) that there are at least 3 persons which have read the ith book for $i = 1, 2, 3, 4$. How many persons must we select before we are guaranteed to have at least 3 persons among the selected, all of which have read the same book q_i for some $i \in \{1, 2, 3, 4\}$?
   - How many persons must we select before we are sure to have 3 persons that have read book q_1. Explain the difference between this result and the answer above.
   - How large must the original group of people be in order to guarantee that it contains two persons who have read the exact same books? Remember that we do not know in advance which books person has read!

2. How many different strings can one make from the word 'predecessors'?

3. Show that if you are given six glasses of water there will either be three with the exact same amount of water or three glasses no two of which contain the same amount of water.

4. January 2010 Problem 1.

5. January 2010 Problem 5(a).

6. January 2009 Problem 2.