Institut for Matematik og Datalogi
Syddansk Universitet

2nd Project — Computer Science 2013

This is your second "studiestartsopgave" for those who did not pass first time. This project is based on your courses DM534, DM535, and DM536, though most directly on DM534 since it overlaps with both of the other two. It covers stating algorithms precisely and being able to follow the execution of an algorithm (as is required in programming) and circuit design (Boolean algebra and logic). The project will be graded on a Pass/Fail basis.

The project is due at 8:15 on Friday, October 11. You may write this either in Danish or English. It must be made in LaTeX, though you may draw some diagrams by hand, scan them in to make PDF files, and then include the PDF files in your LaTeX code. Write your full name, your section number, and your "instruktor"s name (Uffe Thorsen or Magnus Gausdal Find) clearly on the first page of your assignment (on the top, if it's not a cover page). You should turn in both a paper copy of this project (to Joan Boyar's mailbox, which is in the "sekretariat" at IMADA) and an electronic version as a PDF file via Blackboard through your DM534 course. The assignment hand-in is in the menu for the course and is called "SDU Assignment". Keep the receipt it gives you proving that you turned your project in on time. **Blackboard will not allow you to turn in an assignment late.** (Ask for help early if you need help for submitting.)

You will be able to pick up your graded project from Joan Boyar, in her office, during her office hours on October 21.

Cheating on this project is viewed as cheating on an exam. You are allowed to talk about course material with your fellow students, but working together on this project is cheating. If you have questions about the project, come to Joan Boyar or your "instruktor" for DM534.

Please note that this assignment is a compulsory part of your first-year examination. If you fail to hand in the assignment on time, you will be called in to talk with an administrator and may not be able to continue your studies.

The Project

Do the following problems and write your solutions in LaTeX. (Do not include the statements of the problems or other information not asked for in the problems.)

1. Write down a clear, precise algorithm for getting from the university to your home via public transportation. Include any walking that is necessary.

2. Design and draw a circuit containing only AND, OR and NOT gates (each gate having at most two inputs) which takes three bits as input and outputs a 1 if the input is 100, 011, or 010, and a 0 otherwise.

3. Design and draw a circuit containing only AND, OR and NOT gates (each gate having at most two inputs) which takes four bits as input and outputs a 1 if the input is 1010, 0111, 1101 or 1110, and a 0 otherwise.

4. The version of Figure 0.2 from the textbook which was presented on the slides for DM534 is as follows:

   GCD(M, N):
   { Input: two positive integers M, N }
   { Output: gcd(M, N) }

   $A \leftarrow \max(M, N)$
   $B \leftarrow \min(M, N)$

   $Q \leftarrow A$ div B
   $R \leftarrow A - (Q \cdot B)$
   while $R \neq 0$ **do**
   $A \leftarrow B$
   $B \leftarrow R$
   $Q \leftarrow A$ div B
   $R \leftarrow A - (Q \cdot B)$
   return(B)

   Suppose that as input to this is $M = 40$ and $N = 55$. Show the sequence of values for A and B that are computed by the algorithm and the result.

5. Include your LaTeX code for this assignment at the end.