Institut for Matematik og Datalogi
Syddansk Universitet

Assignment 2 — Introduction to Computer Science 2013

This is your second assignment in DM534. The assignment is due at 8:15 on Monday, November 18. You may write this either in Danish or English. It must be made in LaTeX. (though you do not need to include 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 assignment (to Uffe Thorsen's mailbox, which is among all the "instruktor"s mailboxes, if you are in S17; or to Magnus Gausdal Find's mailbox, which is in IMADA's "sekretariat", if you are in S7) and an electronic version as a PDF file via Blackboard through your DM534 course (choose the correct one, S7 or S17). 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 assignment in on time. Blackboard will not allow you to turn in an assignment late.

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

Please note that you must have this assignment approved in order to pass DM534. If it is not turned in on time, or if you do not get it approved, it will count as one of your two retries in the course, and you must have it approved on your only allowed retry for this assignment.

Assignment 2

Do the following problems and write your solutions in LaTeX. Write clear, complete answers, but not longer than necessary. Do not include the statements of the problems or other information not asked for in the problems.)

1. Suppose you are given a list, P, of the first n primes, where n might be large. Design two algorithms that, when given an input, s, finds the smallest index, i, in the list $1 \leq i \leq n$, such that multiplying the ith and $i+1$st primes together gives a result at least as large as s. (Find i such that $P[i] * P[i+1] \geq s$.) The first algorithm should be based on sequential search and the second on binary search.

   (a) Write your algorithms in pseudocode. Explain why they work.

   (b) Analyze the running time of your algorithms (using Θ notation). You may assume that multiplying and comparing numbers takes 1 unit of time. (Think about why this assumption might not be reasonable.) Also, explain how your answer would change if you could assume that $s \leq n$.

2. Use pseudocode to write a recursive algorithm to compute the length of a list. Assume that you have a built-in function to get the next entry in a list and another function to check if there are more items still left in the list. Analyze the running time of your algorithm (using Θ notation).