Institut for Matematik og Datalogi
Syddansk Universitet

September 27, 2010
JFB

# Introduction to Computer Science
# E10 – Lecture 9

## Lecture, September 27, 8:15–10, U37

We covered most of chapter 5 in the textbook, but not insertion sort or software verification.

## Lecture, October 4, 8:15–10, U37

We will finish chapter 5 in the textbook and introduce Maple as an example of a programming language (note that there are notes on the course's homepage about Maple). Types, returning values, and parameter passing will be discussed through examples in Maple.

## Lecture, October 7, 14:15–16, U71

Rolf Fagerberg will lecture on section 9.5 in the textbook (merging and hashing).

## Discussion section: October 11, 14:15–16, Terminal Room

Discussion in groups (only two, or possibly three, people per group, since you will sit at a computer):

1. You can start Maple by typing `xmaple`. The `restart` command is useful when you want to change your worksheet a little and execute it again; it clears all the variables and assignments. (When you want to execute the entire worksheet again, you can do it through the **Edit** menu button and **Execute**.)

In the **Help** menu, click on **Take a Tour of Maple**. Then go through the **Ten Minute Tour**. Try doing the things suggested in the Tour, including right clicking and using the Slider on the animation toolbar. When you differentiate and then integrate, do you get back the original function? Notice the similarity between the code produced in different programming languages. Then, under Help in Maple, click on Manuals, Resources, and more, then on Manuals, and then on Introductory Programming Guide. In Section 1, you can find out how to enter a procedure into your worksheet. Section 6 is particularly useful for returning values from procedures.

2. Plotting data: Start up the statistical package in Maple by typing `with(Statistics);`. Define two lists, the first being [ 100, 200, 300, 400, 500 ], and the second being the number of comparisons by Insertion Sort from your last lab. Try plotting the points with `ScatterPlot(X,Y);` (assuming that is what you called your lists), or add a second argument `color=''Red''` to change to a different color. You can change the shape of the symbols marking the points or add a legend by right clicking on the plot.

   Now try fitting a curve to these points. You can try a quadratic curve with `ScatterPlot(X,Y,fit=[a*x^2 + b*x + c,x])`. To find the constants, you can use `Fit(a*x^2 + b*x + c,X,Y,x)`. Try at least one other type of curve, maybe linear.

   Repeat this with your data from Quick sort. Use $ax \log_2 x + bx + c$ as one of the curves you try.

3. Write a procedure for finding a value in an unordered list, i.e., implement the sequential search algorithm from page 241 (or 223) in the textbook (except do not assume the list is sorted, so the "greater than" test needs to be "not equal"). Test it on some random data.

4. Write a procedure for Insertion sort in Maple. Test it on some random data created with the **Matrix** palette on the left, using integers.

5. Write a procedure for Merge sort in Maple. Test it on some random data.

## Assignment due 12:15, November 10

Late assignments will not be accepted. Working together is not allowed. (You may write this either in English or Danish.) Turn in a copy of your Maple worksheet (don't change it to a PDF file this one time).

Create a Maple worksheet with the following:

- Include text saying your name and the course number, DM526, at the top.
- Write a procedure for finding the cubic root of an integer, using your algorithm from the previous assignment (thus using a binary search technique, returning the cubic root rounded down). Try it on at least 6 different numbers, some of which are perfect cubes (so no rounding down is necessary) and some of which are not. At least two of your numbers should be more than 1000.
- Try differentiating and integrating polynomials of at least 3 different (maximum) degrees.