GEK1536, Computation and Machine, Tutorial 6

(For week 9 starting 6 Mar 2006)

1. Classifying the following numbers according to the categories: (a) natural number, (b) integer, (c) rational number, (d) irrational number, (e) real number, and (f) complex number. Each number may simultaneously belong to several classes.

   (i) 5, (ii) –10, (iii) 0.5, (iv) $\frac{2}{3}$, (v) 0.3333333… (and 3 for ever), (vi) $\sqrt{5}$, (vii) 1 + 3i.

2. Do the following multiplications with four different methods.

   (1) The first method is Gelosia multiplication. The Gelosia method of multiplication is to write down the single digit multiplication result in a square (on the upper triangle for the 10^{th} digit and lower triangle for the unit digit) and then add along the diagonals.
   (2) The second method is to use Napier's bones. You can get a set of Napier's bones by printing a page in the reading material section for week 8.
   (3) The third method is to use Genaille-Lucas rulers. Again you need to print the page to make the rulers.
   (4) The last method is to use slide rule, this is an approximate method. Discuss the principles of slide rule before attempting the answers. For the slide rule, again you have to print a paper version of it from the same paper, if you don't have a real one. Since the slide rule contains scales only from 1 to 9, in order to compute 127×83, you have to first shift the decimal points so that we calculate $1.27 \times 8.3 \approx 10.5$ and then convert back the decimal point as 10500. Due to the finite resolution of your slide rule and due to reading error, you answer will be approximate with perhaps two significant figures. But it can be done very fast.

   (a) 58×27, (b) 127×83, (c) 409×832, (d) 5771×143.

3. Discuss a method to compute the square root of a number with a slide rule. Try this for $\sqrt{2}$.

Home Work (*hand in the following week tutorial*)

4. (**Homework**) The logarithm is defined to be the inverse function of power. If $x = b^y$ then $y = \log_b x$ where $b > 0$ is called the base of logarithm. Compute (with a calculator for some of them) the logarithms of the following numbers in base 2, *e*, and 10.

   (a) 1, (b) 2, (c) *e*, (d) 10, (e) $\sqrt{2}$.

5. (**Homework**) The logarithms of a number in difference bases are related. Suppose that $x = \log_a f$ and $y = \log_b f$ are the logarithms of f in base *a* and *b*, respectively. Find the relation between *x* and *y*. Check that your relation does work for the examples in Prob. 4(e) above among the three bases.

6. (**Homework**) Write a brief description of John Napier's life and scientific work (who invented the bones and algorithms). Your report should not exceed a page, better typed, using a 12-point font. Feel free to search and read information from books and on the web.