GEK1536, Computation and Machine, Tutorial 7

(For week 10 starting 13 Mar 2006)

1. Consider the evaluation of a polynomial
$$f(x) = 2x^3 - x^2 + 3x - 1$$
for x at values 0, 1, 2, …, 9, 10. What steps are involved if it is evaluated in the way of Babbage's difference machine? Carry out the steps and compute the function values. Note that the (forward) difference of a function at x is defined as $\Delta f(x) = f(x+h) - f(x)$. For polynomials of 3rd degree, you need to go up to third order finite difference, $\Delta^3 f$, which is a constant. What is $\Delta^4 f$?

2. Division in complex numbers is also well defined. We can define z_1/z_2 as $z_1 z_2^{-1}$, where the inverse of a complex number is such that
$$z_2\, z_2^{-1} = 1.$$
(a) Let $z_2 = a+ib$, $z_2^{-1} = c+id$. Given z_2 (that is, a and b are known), find an expression for the inverse of z_2^{-1} using the above equation. That is, find c and d in terms of a and b [you need to solved a two-variable system of linear equations].
(d) Another, perhaps simpler way to find the inverse is to multiply z_2 by $z_2^* = a - ib$. do this and find the same expression of inverse of z_2.
(c) Compute the division of following complex numbers.
(i) $1/i$,   (ii) $(2+i)/(1-i)$,   (iii) $0.5/(1+2i)$.

3. Discuss the meanings of the following common terms used in information technology:
   (a) bit, byte, kilobyte (kB), megabyte (MB), gigabyte (GB), terabyte (TB)
   (b) Hertz, megahertz, gigahertz
   (c) second, milli-second, micro-second, nano-second
   (d) programming

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

4. (**Homework**) Write a brief description of the invention of first supercomputer in 1976, known as Cray-1. 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.