# MathSoft design 2009
## Exercise 5
Due date 4/20/09

1. Generating and counting a sequence of ATCG characters

    (a) (20 pts) Let $P_a, P_t, P_c$ and $P_g$ denote probabilities of generating characters 'A', 'T','C', and 'G'. It follows

    $$P_a + P_t + P_c + P_g = 1.$$

    Write a matlab function to generate a sequence of ATCG characters, where occurrence probabilities of the four characters at each position are approximately $P_a, P_t, P_c$ and $P_g$.

    (b) (20 pts) Write a matlab function to count occurrences of the four characters in a string that is generated by the matlab function developed for solving the previous problem.

2. (20 pts) Implement the following procedure in a matlab script

    (a) Get a string that specifies a one-dimensional function, $f(x)$.

    (b) Plot $f(x)$ for $x \in [-5, 5]$.

    (c) Plot $f'(x)$ for $x \in [-5, 5]$.

3. (20 pts) Let $A$ and $B$ denote two $N$-by-$N$ matrices. Use nested FOR loops to determine the product of $A$ and $B$. The kernel of nested FOR loops mainly executes

    $$C(i, j) = A(i, :) * B(:, j),$$

    where $C$ denotes the result of multiplication.

4. (20 pts) Write a matlab function to find the minimum of

    $$g(x_1, x_2) = (x_1^2 + x_2^2 - 13)^2$$

    subject to

    $$\begin{aligned} -2 &\leq x_1 \leq 10 \\ 0 &\leq x_2 \leq 10 \\ x_2 &\leq x_1 \end{aligned}$$