Optimization and simulation
Spring 2015

Enseignant: M.Bierlaire
Assistant: M.Y. Maknoon

Unconstrained Optimization

OBJECTIVE: The aim of this session is to get familiarized with Matlab environment and implement the line search method for unconstrained optimization problems.

STEPS:

1. Download the Matlab files. Read the functions. Here are the list of the files:
   - Line-Search: The framework of the line search algorithm
   - direction-descent.m : Provides descent direction
   - taillepas.m : Computes the step size
   - direction-newton: Computes Newton direction
   - direction-newton-chol: Computes Newton direction based on cholesky factorization
   - f1.m, f2.m, f3.m: Test objective functions as well as the gradient vector and Hessian matrix.
   - normGradient.m : Calculates the norm of the gradient function.
   - visual3d.m: Helps to visualize the results.

   You need to implement the following functions:
   - modchol.m: modified cholesky factorization
   - taillepas-opt.m: optimal direction of steepest descent.
   - taillepas-wolfe.m: uses the first wolf condition for the calculation of step size $f(x_k + \alpha d_k) \leq f(x_k) + \alpha_k \beta \nabla f(x_k)^T d_k$ with $\beta \in \ ]0, 1[$.
   - taillepas-wolf-1-2.m: the two wolf conditions.
2. Test different combinations (Calculating direction and step size) for all test functions. Compare the results in terms of robustness (whether the algorithm finds the minimum) and the convergent speed (the number of iterations). Identify the most efficient combination and explain why we obtain these differences.

DELIVERABLES:

(1) A word file containing the analysis. (2) The whole implemented project. Each group E-mail the documents to yousef.maknoon@epfl.ch. **Deadline: March** 3^{th}.

Remark: The first project is not mandatory. However, groups that returns it within the deadline will receive 10% Bonus from their notes in optimization part.