

## Homework 19 (Use of NAG Library for constrained minimization)

a) Run the code e04ucf.f in NAG Fortran 77 library (see documentation in:

<http://www.nag.com/numeric/fl/manual/pdf/E04/e04ucf.pdf> and

[http://www.csit.fsu.edu/~burkardt/f\\_src/nag\\_f77/nag\\_f77.html](http://www.csit.fsu.edu/~burkardt/f_src/nag_f77/nag_f77.html)

first on its own supplied example:

$$\text{Min } f(x) = x_1 x_4 (x_1 + x_2 + x_3) + x_3$$

Subject to:

$$\begin{cases} 1 \leq x_i \leq 5, i = 1, 2, 3, 4 \\ x_1 + x_2 + x_3 + x_4 \leq 20 \\ x_1^2 + x_2^2 + x_3^2 + x_4^2 \leq 40 \\ x_1 x_2 x_3 x_4 \geq 25 \end{cases}$$

With initial point  $x_0 = (1, 5, 5, 1)^T$

Read documentation supplied of how to copy the example and run it, explain the method used (sequential quadratic programming), explain the output and verify that indeed the solution obtained is feasible.

See documentation of how to run it on blackboard.

b) Run the same code on the following constrained minimization problem:

$$\text{min } f(x) = 1 + x_1 + x_2 + x_3 + x_4$$

Subject to:

$$\begin{cases} 0.001 \leq x_i \leq (5-i)10^5, i = 1, 2, 3, 4 \\ 0.0401 - 4/x_1 - 2.25/x_2 - 1/x_3 - 0.25/x_4 \geq 0 \\ 0.010085 - 0.16/x_1 - 0.36/x_2 - 0.64/x_3 - 0.64/x_4 \geq 0 \end{cases}$$

With initial starting point:

$$x_0 = (1,1,1,1)^T$$

Verify again feasibility.

Explain briefly the SQP method and its different component the Q-N BFGS.

Discuss results of the output.

To implement second problem you need to modify the values of OBJGRD (i) in subroutine OBJFUN and OBJF in same routine.

Also you need to modify vectors CJAC(1,i) and CJAC(2,i) , i=1,2,3,4 in subroutine CONFUN as well as C(1) and C(2) in same routine.

The data for running the code are stored in file: e04ucfe.d

Please read documentation on blackboard as well as entire file for the NAG program e04ucf.

Consult literature suggested by NAG to enrich your knowledge.