Introduction to Nonlinear Programming

Homework #7 – Due Friday, May 27

1. We let [0, 5] be the initial interval of uncertainty and require the final length of uncertainty must be lower than 0.01. Find the minimum of $6e^{-2\lambda}+2\lambda^2$ by the Dichotomous search method (let $\varepsilon=0.001$).

2. Consider the function f defined by $f(x)=(x_1+x_2^3)^2+2(x_1-x_2-4)^4$. Given a point x^1 and a nonzero vector $\mathbf{d}$, let $\theta(\lambda)=f(x^1+\lambda\mathbf{d})$.
   a. Obtain an explicit expression for $\theta(\lambda)$.
   b. For $x^1=(0, 0)^t$ and $\mathbf{d}=(1, 1)^t$, using the Fibonacci method, find the value of λ that solves the problem to minimize $\theta(\lambda)$ subject to $\lambda\in\mathbf{R}$. (We also let the final length of uncertainty $l=0.01$, distinguishability constant $\varepsilon=0.001$ and [0, 5] be the initial interval of uncertainty.)
   c. For $x^1=(5, 4)^t$ and $\mathbf{d}=(-2, 1)^t$, using the Golden section method, find the value of λ that solves the problem to minimize $\theta(\lambda)$ subject to $\lambda\in\mathbf{R}$. (We let $[a_1, b_1]=[-2, 2]$ and the length of uncertainty l is 0.01.)

3. We let [0, 5] be the initial interval of uncertainty and require the final length of uncertainty must be lower than 0.01. Find the minimum of $6e^{-2\lambda}+2\lambda^2$ by each of the following procedures:
   a. Newton's method ($\lambda_1=1$, $\varepsilon=0.001$).
   b. Bisection search method.

4. Consider the problem to minimize $(3-x_1)^2+7(x_2-x_1^2)^2$. Starting from the point (0, 0), solve the problem by the following procedures:
   a. The cyclic coordinate method. ($\varepsilon=0.2$)
   b. The method of Davidon-Fletcher-Powell. ($\varepsilon=0.2$)
   c. The method of steepest descent. ($\varepsilon=2$)