Homework # 3 (Due March 27, 2008)

1. We wish to solve Problem 2.6 of Belegendu's book (page 48) using the integrated bracketing and the golden section method. . For this problem, set your design variable *x* as *x=d/D*.

   (Correction: $\sigma = \dfrac{Kp}{D-d}$ should be replaced by $\sigma = \dfrac{KpD}{D-d}$.)

   a) Find the solution, i. e., $x_{\min} = (d/D)_{\min}$, $\sigma_{\min}$, $K_{\min}$.
   (Note that *x* lies in [0.001, 0.999].) Here, you should plot the iteration history. Select the stopping criteria based on i) the design variable only , ii) the function value only, and iii) the design variable or the function value.

   b) Examine the number of iterations as the convergence criteria become tighter. Comment on your results.

   * *You should attach your Matlab code for the integrated bracketing and the golden section method*.

2. Solve Problem 2. 10 of Belegendu's book (page 49) using your Matlab code developed for Problem 1.

   (Correction: $\alpha = a/b$ $(not\ \ b/a)$)

   unit: $S_1 = 1.0\times10^6$ N/mm

   $S_2 = 6.0\times10^5$ N/mm

   $E = 2.1\times10^5$ N/mm^2

   $d = 75$ mm, $a = 100$mm

   $I = \pi d^4/64$

   Choose the search interval I=[0.001 10]

3. If $f(x)$ has a double root at $x = \hat{x}$, so that $f'(\hat{x})$ =0, then the condition

$$\left|\frac{f(x)f''(x)}{[f'(x)]^2}\right| < 1 \qquad (1)$$

may not hold for any interval including $\hat{x}$. Therefore, Newton's method may not converge. You can check, however, that for the simple equation $x^2 - 4x + 4 = 0$ having a double root at *x=2*, Newton's method will converge. Show that Condition (1) is still satisfied at $x = \hat{x}$ (Consider the limiting behavior as $x \to \hat{x}$).