UMC 202
PROBLEM SET 9

(1) Apply the Linear Shooting technique with $N = 10$ to the boundary value problem

$$y'' = \frac{-2}{x}y' + \frac{2}{x^2}y + \frac{sin(ln\,x)}{x^2}, \text{ for } 1 \leq x \leq 2,$$
$$\text{with } y(1) = 1 \text{ and } y(2) = 2,$$

and compare the results to those of the exact solution

$$y = c_1\,x + \frac{c_2}{x^2} - \frac{3}{10}sin(ln\,x) - \frac{1}{10}\,cos(ln\,x),$$

where $c_1 = -0.039$ and $c_2 = 1.139$.

(2) The boundary value problem

$$y'' = 4(y - x),\ \ 0 \leq x \leq 1,\ y(0) = 0,\ y(1) = 2,$$

has the solution $y(x) = e^2(e^4-1)^{-1}(e^{2x}-e^{-2x})+x$. Use the Liner Shooting method to approximate the solution and compare the results to the actual solution for $h = \frac{1}{4}$.

(3) Apply the shooting method with Newton's method to the boundary value problem

$$y'' = \frac{1}{8}(32 + 2x^3 - yy'),\ \text{ for } 1 \leq x \leq 3,$$
$$\text{with }\ y(1) = 17\ \text{ and } y(3) = \frac{43}{3}.$$

Use $N = 20$, $M = 10$ and $TOL = 10^{-5}$, and compare the results with the exact solution $y(x) = x^2 + \frac{16}{x}$.

(4) Use the Nonlinear Shooting method with $h = 0.5$ to approximate the solution to the boundary value problem

$$y'' = -(y')^2 - y +\ ln\,x,\ \ 1 \leq x \leq 2,\ y(1) = 0,\ y(2) = ln\,2.$$

Compare the results to the actual solution $y = ln\,x$.