King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering

CISE 301 – Numerical Methods (T152)

Homework # 02 (due date & time: Sunday 14/02/2016 during class period)

***** Show all your work. No credit will be given if work is not shown! *****

Problem 1 (10 points): Use the bisection method to determine the real root of $f(x) = 5x^3 - 7x^2 + 6x - 2.3$. Employ initial guesses of $x_l = 0$ and $x_u = 1$ and iterate until the estimated error ε_a falls below a level of $\varepsilon_s = 5\%$.

Problem 2 (10 points): Use the bisection method to determine the real zero of $\cos(x) = x^3$. Employ initial guesses of $x_l = 0.5$ and $x_u = 1$ and iterate until the estimated error ε_a falls below a level of $\varepsilon_s = 2\%$. Also, perform an error check by substituting your final answer into the original equation.

Problem 3 (30 points): Use each of the following methods to determine the real root of $f(x) = 2x^3 - 11.5x^2 + 17.9x - 4$.

(a) Newton-Raphson method (three iterations, $x_0 = 3$).
(b) Secant method (three iterations, $x_{-1} = 3$, $x_0 = 4$).
(c) Modified secant method (three iterations, $x_0 = 3$, $\delta = 0.01$).

Problem 4 (10 points): Use the Newton-Raphson method to determine the real root of $f(x) = -x^2 + 1.9x + 3$ using $x_0 = 5$. Perform the computation until the estimated error ε_a falls below a level of $\varepsilon_s = 0.05\%$. Also, perform an error check by substituting your final answer into the original equation.

Problem 5 (20 points): Locate the real root of $f(x) = \cos(x) - \sin(1 + x^2) + 1$ using each of the following:

(a) Secant method (four iterations, $x_{i-1} = 2.0$, $x_i = 4.0$).
(b) Secant method (four iterations, $x_{i-1} = 3.25$, $x_i = 3.5$).

Problem 6 (20 points): Using initial guesses $x = y = 1.2$, determine the roots of the following simultaneous nonlinear equations using the Newton-Raphson method:

$$y = -x^2 + 1.5x + 0.5$$
$$2y + 5xy = x^2$$

Perform the computation until the estimated error $max(\varepsilon_{ax}, \varepsilon_{ay})$ falls below a level of $\varepsilon_s = 0.05\%$.