UMC 202
PROBLEM SET 8

(1) Use two step Adam-Bashforth explicit method to approximate the solutions of the following initial value problems. Compute the value of the solution at the end point of the interval and find the error

(a) $y' = te^{3t} - 2y, \quad 0 \le t \le 1, \quad y(0) = 0,$ with $h = 0.2$, actual solution $y(t) = \frac{1}{5}te^{3t} - \frac{1}{25}e^{3t} + \frac{1}{25}e^{-2t}$.

(b) $y' = 1 + (t-y)^2, \quad 2 \le t \le 3, \ y(2) = 1$ with $h = 0.2$, actual solution $y(t) = t + \frac{1}{(1-t)}$.

(c) $y' = 1 + \frac{y}{t}, \quad 1 \le t \le 2, \quad y(1) = 2,$ with $h = 0.2$, actual solution $y(t) = t\ln t + 2t$.

(2) Redo problem 1 by the two step Adams Moulton implicit method. Compare the results with Adam-Bashforth explicit method.

(3) Redo problem 1 by the three step Adams Bashforth explicit method and three step Adams Moulton implicit method. Compare the results.

(4) Apply the Adams fourth order predictor corrector method with $h = 0.2$ and starting values from the Runge Kutta fourth order method to the initial value problem

$$y' = y - t^2 + 1, \quad 0 \le t \le 2, \quad y(0) = 0.5.$$

(5) Use the Runge Kutta method of order two to approximate the solution of the following problem and compare the result to the actual solution

$$u_1' = 3u_1 + 2u_2 - (2t^2+1)e^{2t}, \ u_1(0) = 1,$$
$$u_2' = 4u_1 + u_2 + (t^2 + 2t - 4)e^{2t}, \ u_2(0) = 1,$$
$$0 \le t \le 1, \quad h = 0.2.$$

actual solutions $u_1(t) = \frac{1}{3}e^{5t} - \frac{1}{3}e^{-t} + e^{2t}$ and $u_2(t) = \frac{1}{3}e^{5t} + \frac{2}{3}e^{-t} + t^2e^{2t}$.