DEPARTMENT OF MATHEMATICS, I.I.T. GUWAHATI

MA 322: Scientific Computing Lab - XII

1. Consider the following IVP's:

   (a) $y' = 1 + y/t + (y/t)^2$, $1 \leq t \leq 3$, $y(1) = 0$ with $h = 0.2$; actual solution $y(t) = t\tan(\ln t)$.

   (b) $y' = -ty + 4ty^{-1}$, $0 \leq t \leq 1$, $y(0) = 1$ with $h = 0.1$; actual solution $y(t) = \sqrt{4 - 3e^{-t^2}}$.

   Use Adams-Bashforth and Adams-Moulton methods to approximate the solutions to the IVPs given in Question 1.

   (a) Use exact starting values.

   Compare the results to the actual values.

2. Consider the following problem

$$y' = -2y + 1, \ 0 \leq t \leq 1, \ y(0) = 1.$$

   Solve it by using the following methods:

   (a) Explicit Euler.

   (b) Implicit Euler.

   (c) $y_{n+1} = y_{n-1} + 2hf(t_n, y_n)$.

   Vary h and check the stability of these methods. Exact solution for this problem is $\dfrac{e^{-2x} + 1}{2}$.

3. Consider the IVP

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

   Use the exact solution $y(t) = (t + 1)^2 - 0.5e^t$ to get the starting values and $h = 0.2$ to compare the approximations got by implementing the explicit Adams-Bashforth four-step method and the implicit Adams-Moulton three-step method.

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 IVP given in Question 3.