

MATH 5620 NUMERICAL ANALYSIS II
HOMEWORK 3, DUE FRIDAY FEBRUARY 17 2012

Notes: Please do not lose time solving systems or finding roots of polynomials by hand (unless the roots are trivial to find). You can use Matlab, Maple etc. . .

Problem 1 (K&C 8.4: 4,5) Use the method of undetermined coefficients we saw in class to derive:

(a) The fourth-order Adams-Bashforth method:

$$y_{n+1} = y_n + \frac{h}{24}(55f_n - 59f_{n-1} + 37f_{n-2} - 9f_{n-3})$$

(b) The fourth-order Adams-Moulton method:

$$y_{n+1} = y_n + \frac{h}{24}(9f_{n+1} + 19f_n - 5f_{n-1} + f_{n-2})$$

Note: For full credit you need to specify the linear system you used to find the coefficients. The systems are easier to setup if you use the appropriate polynomial basis, i.e. $1, t, t+1, t+2, \dots$. Most of the values in these matrices were already given in the class notes.

Problem 2 (K&C 8.4.16) Determine the order of the method

$$y_n = y_{n-2} + 2hf_{n-1}$$

using the procedure outlined in class (compute $d_0, d_1, \dots$ stopping at the first non-zero d_{m+1} . The method will be of order m .)

Problem 3 (K&C 8.5.1) Determine whether each of the following methods is stable, consistent or convergent. Please use the definitions of stability and consistency we saw in class.

(a) $y_n - y_{n-2} = 2hf_{n-1}$

(b) $y_n - y_{n-2} = (h/3)(7f_{n-1} - 2f_{n-2} + f_{n-3})$

(c) $y_n - y_{n-1} = (h/24)(9f_n + 19f_{n-1} - 5f_{n-2} + f_{n-3})$

Problem 4 B&F 5.6.2 and 5.6.6 (a,b only). Please see the sample drivers, stubs and output in the class website. **All the stubs assume that `rk4.m` (from HW2) is in the same directory.**