Department of Mathematical and Computational Sciences
National Institute of Technology Karnataka, Surathkal
Numerical Analysis - MA 704
Problem Sheet 3

Dr. P. Sam Johnson (nitksam@gmail.com) http://sam.nitk.ac.in/

1. By Bairstow's method, solve the equation $x^4 + 5x^3 + 3x^2 - 5x - 9 = 0$ starting with $u = 3$ and $v = -5$. Carry out 3 iterations.
2. Using Bairstow's method, determine a quadratic factor $x^4 - 5x^3 + 20x^2 - 40x + 60 = 0$. Start with $u = 1$ and $v = 1$ and carry out 3 iterations.
3. By Bairstow's method, solve $x^4 - 8x^3 + 39x^2 - 62x + 50 = 0$. Start with $u = 0 = v$ and carry out three iterations.
4. Using Graeffie root squaring method, solve the following equations (squaring 3 times).
   (a) $x^3 - 5x^2 - 17x + 20 = 0$
   (b) $x^3 - x - 1 = 0$
   (c) $32x^3 - 6x - 1 = 0$
   (d) $x^4 + x^3 - 6x^2 - 14x - 12 = 0$.
5. Find the unique polynomial $P(x)$ of degree 2 or less such that $P(1) = 1, P(3) = 27, P(4) = 64$ by using Lagrange interpolation formula. Evaluate $P(1.5)$.
6. Compute $f(3)$ from the following table using Lagrange formula.

x	0	1	2	4	5	6
$f(x)$	1	14	15	5	6	19

7. Apply Hermite interpolation and estimate $l_n(2.7)$ from the following data

x_i	2.0	2.5	3.0
$l_n(x_i)$	0.693147	0.916291	1.098612
$\frac{1}{x_i}$	0.500000	0.400000	0.333333

   Also determine the bound for the error of approximation.
8. Construct the Hermite interpolating polynomial of degree 7 to the following data. Hence estimate $f(1)$.

x_i	-2	0	3	4
$f(x_i)$	-63	1	82	513
$f'(x_i)$	16	0	189	768

9. Estimate $f(1.2)$ for the function $f(x) = e^{-2x}$ by constructing Hermite interpolating polynomial corresponding to the following data.

x_i	0.0	1.0	2.0
$f(x_i)$	1.0	0.135335	0.018316
$f'(x_i)$	-2.0	$-.270671$	-0.36631

10. Values of the function $f(x) = e^x$ are given in the following table at $x = 0, 0.5$ and 1.0. Obtain a bound on the error of the estimate of Hermite polynomial $H_5(0.75)$ and compare with the actual error.