DEPARTMENT OF MATHEMATICS, IIT - GUWAHATI
Odd Semester of the Academic year 2015 - 2016
MA322 & MA311M Assignment/Problem sheet 3
Instructor: Dr. J. C. Kalita
Due before midnight of 23 August 2015

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1. Find the approximations to within 10^{-4} to all real zeros of the following polynomials using Newton's and secant method.
(a) $f(x) = x^3 - 2x^2 - 5$ (b) $f(x) = x^3 + 4.001x^2 + 4.002x + 1.101$ (c) $f(x) = x^5 - x^4 + 2x^3 - 3x^2 + x - 4$.
What can you comment on the number of iterations and accuracy of the two methods based on your run?

2. The function defined by $f(x) = \ln(x^2+1) - e^{0.4x}\cos \pi x$ has an infinite number of zeros.
(a) Determine, within 10^{-6}, the only negative zero.
(b) Determine, within 10^{-7}, the four smallest positive zeros.
(c) Determine a reasonable initial approximation to find the nth smallest positive zero of f.
(*Hint: Sketch an approximate graph of* f.)
(d) Use part (c) to determine, within 10^{-7}, the 25th smallest positive zeros of f.

3. Find an approximation for λ, accurate within 10^{-6}, the population equation

$$1,564,000 = 1,000,000e^{\lambda} + \frac{435,000}{\lambda}(e^{\lambda} - 1).$$

4. Let $f(x) = 3^{3x+1} - 7.5^{2x}$.
(a) Plot $f(x)$ to find initial approximate approximations to the roots of f.
(b) Use Newton's method to find the roots within 10^{-16}.

5. $f(x) = (x+1)^3(x-1)$ obviously has roots at $x = -1$ and $x = 1$.
(a) Using starting values that differ from the roots by 0.1, compare the number of iterations taken when Newton's method computes both of the roots until they are within 0.0001 of the correct values.
(b) Beginning with the interval $[0.9, 1.1]$, use the secant method on the root at $x = -1$. Can you explain why secant method works better than Newton's method in this case?