MATH 317: Numerical Analysis

Assignment 1 : Due Monday 2 October, 2017

Important: Submit a complete hard copy of all your solutions either in class or to the Math Dept Office opposite the elevators on the 10th floor of Burnside before 4 pm of the due date; this must include Course number, name and id number (or it will get lost). Solutions should be complete and include a hard copy of all electronic output, and code, together with explanations. **Do not email us pdf's!** Work not submitted on paper will not be graded. Submit all relevant program files and documentation to explain them. Get in the habit of including comments in your code. Write your own code! Otherwise, why are you here?

1. a) How accurately do we need to know π to be able to compute $\sqrt{\pi}$ with four correct decimals? b) Convert the binary number 11.101101 to base 10.

2. i) Say we want to calculate $e^x - e^{-x}$ in a small neighbourhood of x near zero. What would be the most accurate way to do this? ii) How about $f(x) = \left[\sqrt{1+x^2} - \sqrt{1-x^2}\right]^{-1}$ in a small neighbourhood of x near zero?

3. Compute the root of the equation $f(x) = \sqrt{x} - e^{-x}$ using the secant method and Newton-Raphson. You need to make initial guesses. Try a few.

4. For the problem above consider the two fixed-point iterations: $x_{n+1} = e^{-2x_n}$ and $x_{n+1} = -\frac{1}{2}\ln x_n$. Code these up and compare their performance to the methods of question 3 above. Explain the behaviour.

5. Determine the free parameter λ such that

$$x_{n+1} = \frac{\lambda x_n + 1 - \sin x_n}{1+\lambda}$$

converges as fast as possible to the root of the equation $1 - x - \sin x = 0$. Compute the root to 6 decimals.