MTH 351: Homework 3

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1. Explanation of how initial interval for bisection method was computed.

   To find an interval that contains $1/z$ I took advantage of the float datatype format to bound $1/z$ between 0.5^e and 0.5^{e+1}. The first step is to convert z to a double than extract the exponent bits. The eleven exponent bits are bits 63 through 53. Subtracting 1023 from the exponent bits give e such that $z = z' * 2^e$ where z' is the digits of z shifted so that they are in scientific notation. Since z is now in scientific notation $2^e <= z < 2^{e+1}$. Taking the reciprocal of all terms the inequality can be rewritten as $0.5^{e+1} < 1/z <= 0.5^e$. These are used as the bounds so $a = 0.5^{e+1}$ and $b = 0.5^e$.

2. Conclusions from plot of convergence of the bisection and Newton-Raphson methods.

   Comparing the convergence plots of the bisection and the Newton-Raphson methods is is clear the the Newton-Raphson method converges faster. While the convergence of the bisection method appears linear on the semi log scale the Newton-Raphson method converges in about five iterations independent of z.