MTH 343 Numerical Analysis: Quiz 1

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1C Compute the absolute and relative error in approximations of p by p^*.

$$p = \pi \qquad\qquad p^* = 3.1416$$

2A Find the largest interval in which p^* must lie to approximate p with relative error at most 10^-4.

$$p = \sqrt{2}$$

3A,B Suppose p^* must approximate p with relative error at most 10^{-3}. Find the largest interval in which p^* must lie for:

$$p_a = 150 \qquad\qquad p_b = 900$$

4 Perform the following computations (i) exactly, (ii) using three-digit chopping arithmetic, and (iii) using three-digit rounding arithmetic. (iv) Compute the relative errors in parts (ii) and (iii).

$$\frac{4}{5} + \frac{1}{3}$$

$$\frac{4}{5} \cdot \frac{1}{3}$$

$$(\frac{1}{3} - \frac{3}{11}) + \frac{3}{20}$$

$$(\frac{1}{3} + \frac{3}{11}) - \frac{3}{20}$$

5C,E,G Use three-digit rounding arithmetic to perform the following calculations. Compute the absolute error and relative error with the exact value determined to at least five digits.

$$(121 - 0.327) - 119$$

$$\frac{\frac{13}{14} - \frac{6}{7}}{2e - 5.4}$$

$$(\frac{2}{9}) \cdot (\frac{9}{7})$$

6E Repeat exercise 5 using four digit rounding arithmetic.

15 A,B Use the 64-bit long real format to find the decimal equivalent of the following floating-point machine numbers:

(a) 0 10000001010 1001001 1000000000000000000000000000000000000000000000000

(b) 1 10000001010 1001001 1000000000000000000000000000000000000000000000000

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1 Use the Bisection method to find p_3 for $f(x) = \sqrt{x} - \cos x \text{on} [0, 1]$.

3 A,B Use the Bisection method to find solutions accurate to within 10^{-2} for $x^4 - 2x^3 - 4x^2 + 4x + 4 = 0$ on the intervals [-2,-1] and [0, 2].

5 B,C 6B Use the Bisection method to find solutions, accurate to within 10^{-5} for the following problems:

- $2x + 3\cos x - e^x = 0$ for $1 \leq x \leq 2$ and $2 \leq x \leq 4$
- $x^2 - 4x + 4 - \ln x = 0$ for $0 \leq x \leq 0.5$ and $0.5 \leq x \leq 1$
- $e^x - x^2 + 3x - 2 = 0$ for $0 \leq x \leq 1$

11A Let $f(x) = (x + 2)(x + 1)x(x - 1)^3(x - 2)$. To which zero of f does the Bisection method converge when applied on the interval $[-1.5, 2.5]$

13 Find an approximation to $\sqrt{25}$ correct to within 10^{-4} using the Bisection Algorithm.