

University of Central Florida

Department of Electrical Engineering and Computer Science
COT 4500 Numerical Calculus
Quiz 1 (Spring 2013)

For all exercises show all your work step by step.

1.- Use three-digit rounding arithmetic to perform the following calculation. Compute the absolute and relative error with the exact value determined to at least five digits.(20 points)

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

2.- What is the exact value of following 64 bits, interpreted with the IEEE 754-2008 Binary Floating Point Arithmetic Standard?(20 points)

11000000 01111001 01000000 00000000 00000000 00000000 00000000 00000000

3.- A function f is defined by the series

$$f(x) = \sum_{k=1}^{\infty} (-1)^k \left(\frac{x^k}{k^4}\right)$$

Determine the minimum number of terms needed to compute $f(1)$ with error less than 10^{-8} .(20 points)

4.- Let $f(x) = 2x \cos(2x) - (x - 2)^2$ and $x_0 = 0$

- a) Find the third Taylor polynomial $P_3(x)$, and use it to approximate $f(0.4)$.
b) Use the error formula in Taylor's Theorem to find an upper bound for the error $|f(0.4) - P_3(0.4)|$. Compute the actual error.(20 points)

5.- Suppose that the significand field has room only to store $b0.b1b2$, and that the only possible values for the exponent E are $-1, 0$ and 1 :

- a) What is the largest normalized floating point number that can be represented(show result in binary and decimal)
b) What is the smallest normalized floating point number that can be represented(show result in binary and decimal)
c) What is the precision or machine epsilon(ϵ)?
d) How many subnormal numbers can be representd? Show those numbers in binary and decimal. (20 points)