AM5600: Computational Methods in Mechanics (July-Nov. 2019)

Assignment #1

Due: At the beginning of class on Aug 13, 2019

1. Find the number(s) *c* referred to in the mean value theorem for each function over the indicated interval.

(a) $f(x) = \sqrt{x}\,, x \in [0,4]$

(b) $f(x) = \frac{x^2}{x+1}, x \in [0,1]$

2. Find the number(s) *c* referred to in the Rolle's theorem for each function over the indicated interval.

(a) $f(x) = x^4 - 4x^2, x \in [-2,2]$

(b) $f(x) = sin\,(x) \; + sin\,(2x)\,, x \in [0,2\pi]$

3. Convert the following numbers to their binary form; the subscript denotes the basis

(a) $(320)_6$

(b) $(706)_8$

(c) $(68)_{10}$

(d) $(42.15)_6$

(e) $(540.5)_8$

(f) $(0.325)_{10}$

4. Convert the following binary numbers to decimal form

(a) $(111000)_2$

(b) $(10101)_2$

(c) $(110.1010101)_2$

(d) $(0.110110110)_2$

5. Find the relative error for addition and multiplication of two numbers.

6. Find the Taylor series expansion of the following functions and determine the order of approximation for their sum and product respectively ($|h| < 1$).

$f(x) = cos(h)$ up to $O(h^6)$; $g(x) = \frac{1}{1-h}$, up to $O(h^4)$

AM5801/AM5810: Computational Lab (optional for students crediting AM5600)

Due: At the end of lab on Aug 14, 2019

1. Determine the number of terms necessary to approximate $cos(x)$ to 8 significant figures (relative error $< 5 \times 10^{-7}$) using the McLaurin series approximation. Calculate the approximation using a value of $x = 0.3\pi$. Write a program to determine your result and compare with MATLAB inbuilt cosine and function. Plot relative error vs. number of terms in the series.
2. Write a generalized code to convert any decimal number N_{10} (where *10* is the base) to binary system. Verify the algorithm by solving the Q3 in the above section.
3. Find square root of any number 'N' by divide and average method $x_{new} = \frac{\left(\left(\frac{N}{x_{guess}}\right) + x_{guess}\right)}{2}$.