HOMEWORK #1

Due: January 25 (Thursday) by midnight

Instructions:

- The assignment consists of *two* questions, worth 2 and 6 points.
- Submit your assignment *electronically* (via Email) to the address `math4q03@math.mcmaster.ca`; hardcopy submissions will not be accepted.
- It is obligatory to use the MATLAB template file available at `http://www.math.mcmaster.ca/~bprotas/MATH4Q03/template.m` (see also the link in the "Computer Programs" section of the course website on the left); submissions non compliant with this template will not be accepted.
- Make sure to enter your name and student I.D. number in the appropriate section of the template.
- Late submissions and submissions which do not comply with these guidelines will not be accepted.

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1. Write a MATLAB code which will estimate the level of round–off errors in a computer; more specifically do the following:

   (a) without using the intrinsic function `eps`, determine the value of ε for which $1.0+\varepsilon$ becomes indistinguishable from 1.0,

   (b) display where the round–off error appears by drawing a log–linear plot of $\frac{(1.0+\varepsilon)-1.0}{\varepsilon}$ as a function of ε.

   (2 points)

2. Consider the function $f(x)=\sin(x)-\frac{1}{2}$ and write a MATLAB code that will perform the following tasks:

   (a) draw a plot of this function in the interval $\Omega=[x_1,x_2]$, where $x_1=0$ and $x_2=\frac{\pi}{2}$ (use red color for the line),

   (b) use the three codes posted on the course website (i.e., `bisect.m`, `secant.m` and `fixpoint.m`) to find the root x_0 of the equation $f(x)=0$ in the interval Ω; use x_1 and, if needed, x_2 to initialize the iterations,

   (c) write you own MATLAB code that that will implement Newton's method to solve this problem,

   (d) draw a log–log plot of the quantity $|x_n-x_0|$ as a function of n (the iteration index) for the results obtained using the four methods mentioned above; use different symbols to mark data points corresponding o the different methods.

   Note that you may need to modify the MATLAB codes provided to ensure that they return suitable data.
   HINT — When using the fixed–point iterations, transform the problem to the form $g(x)=x$, where $g(x)=-\sin(x)+\frac{1}{2}+x$.
   (6 points)