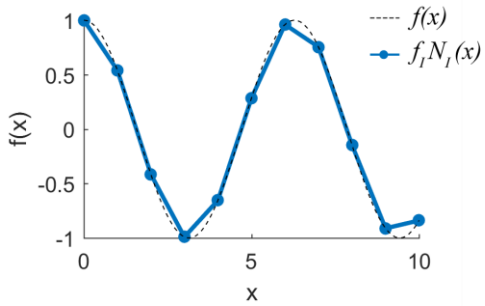
MAE 404/598 Finite Elements in Engineering
Programming assignment #4

Write a MATLAB function to calculate the error that shape functions make in representing a function and its derivative. Given the function $f(x) = cos(x)$ over the domain from x = 0 to x = 10, construct a one-dimensional mesh composed of equally sized 2-node elements.



Define nodal values f_I defined as $f_I = f(x_I)$, where x_I are the nodal coodinates. Your code should compute:

$$e_1 = \left[\int_0^{10} \left(f(x) - f_I N_I(x) \right)^2 dx \right]^{\frac{1}{2}} \qquad e_2 = \left[\int_0^{10} \left(\frac{df}{dx} - f_I \frac{dN_I}{dx} \right)^2 dx \right]^{\frac{1}{2}}$$

You can verify that your code is correct by checking that e_1 and e_2 approach zero as the number of nodes is increased.

Instructions for programming and assignment submission:

- For this assignment, submit only a single MATLAB code named "**asurite_hw4.m**".
- The file **must** define a function of the same name as the file name (but without the ".m") , e.g.

```
function [e1, e2] = asurite_hw4(n)
    % Code goes here to compute e1 and e2.
end
```

- The input variable ***n*** gives the number of nodes in the mesh.
    - The output variables ***e1*** and ***e2*** should return the calculated integrals shown above.

Your submission will be graded electronically. Failure to comply with the above instructions may result in zero credit.

Bonus (submit either pdf or word document via Blackboard):

Read sections 5.6 and 5.6.1 of the textbook and determine the ***rate of convergence*** of the error measures, e_1 and e_2. Write a single page explaining how you determine the converge rate and show plots comparing the element size to the computed errors. Upload your assignment to Blackboard prior to the Feb 11 deadline.

Submit your assignment to http://sparky.fulton.asu.edu/fe/index.php

Can be resubmitted daily until Thursday Feb 11 at 12 midnight.