CS310 **Assignment 1** Fall 1999

Prof. Blanchard Due date: Sept. 21, 1999

Prof. Strikwerda Due date: Sept. 22, 1999

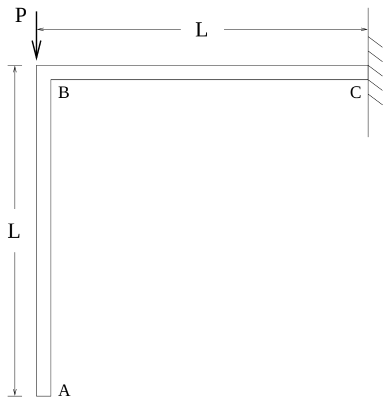
This problem deals with finding the load that the column in the two member frame shown in the figure can support without buckling. From structural mechanics the critical load P_{cr} is given by

$$P_{\mathrm{cr}} = \left(\frac{z}{L}\right)^2 EI \tag{1}$$

where z is the smallest positive solution to the nonlinear equation

$$\tan z = \frac{z}{1 + z^2/4} \,. \tag{2}$$

The quantity EI is the beam stiffness and L is the length of the column. The value of EI is 1.13×10^7 newtons (meters)^2 and the length L is 11.5 meters.



1. (10 points) Use the plotting function of Maple to estimate the smallest positive root of equation (2).
   Estimate the root to two decimal places.

2. (20 points) Use Excel to program the bisection method for finding the smallest positive value satisfying equation (2). Find the root to 5 decimal places. Find the critical load. (You may put the computation of the critical load on your spreadsheet.)
   How many steps did it take for the bisection method to obtain the 5 decimal place accuracy?

3. (20 points) Use Excel to program the secant method for finding the root of equation (2). For the initial two values, use the initial endpoints that you used for problem 2. Find the root to 5 places. Find the critical load.
   How many steps did it take for the secant method to obtain the 5 decimal place accuracy?

   Check the course web page for instructions on handing in the assignment.