Assignment 2

Numerical Computing
B. Math. Year 1,
January - May 2022.

Due on: March 30^{th}, 2022.

Please give arguments where necessary. If it is unclear from your answer why a particular step is being taken, full credit will not be awarded. Please feel free to discuss amongst yourselves; however, copying the assignment solutions from someone else is strictly prohibited and both persons involved will be penalized. Each one of you must submit your own answers. Total: **55 points**.

- Please note the following abbreviation for this and subsequent assignments:
  AH: *Elementary Numerical Analysis*, *Third Edition*, Kendall Atkinson and Weimin Han, Wiley & Sons, 2004.

1. (a) Find the smallest non-zero root of the equation $x = \tan(x)$ by the bisection method to an accuracy of $\varepsilon = 1.0 \times 10^{-7}$ (Please provide the code and the subsequent intervals with your answer). Mention the number of iterations it took for the required convergence to be attained. Does your number of iterations satisfy the inequality governing it given the tolerance? If not, explain why. [10 + 2 + 3]

   (b) Knowing the solution above, use Newton's method for finding the same solution as above (submit the code as well as your iteration table). Discuss the convergence of Newton's method regarding this equation vis-a-vis the bisection method. [12 + 3]

2. (a) Problem 3, page 106, **AH** [10 points].

   (b) Problem 5, page 107, **AH** [5 points].

   (c) Problem 11, page 108, **AH** [5 points].

   (d) Problem 12, page 108, **AH** [5 points]. (You can play around endlessly with this problem, see the hint below the problem in the textbook. The points above are only for the question regarding the convergence. I would love to see some of you discussing what happens when you keep increasing c as suggested. The logistic equation is where study of chaotic dynamics started, and afterwards, things like fractals and other fun things came tumbling out. Have fun.)