Offline 1: Finding Roots of Nonlinear Equations Using Bisection Method

In a chemical engineering process, water vapor (H_2O) is heated to sufficiently high temperatures that a significant portion of the water dissociates, or splits apart, to form oxygen (O_2) and hydrogen (H_2):

$$H_2O \leftarrow\rightarrow H_2 + 1/2\ O_2$$

If it is assumed that this is the only reaction involved, the mole fraction x of H_2O that dissociates can be represented by

$$K=x/(1-x) * \sqrt{(2p_t/(2+x))}$$

where K is the reaction's equilibrium constant and p_t is the total pressure of the mixture. If p_t= 3 atm and K = 0.05, determine the value of x that satisfies given equation.

Write a python program that does the following (20):

- Uses bisection method to estimate the value of x for ε_s=0.5%. The bisection method should be implemented as a function having the following parameters: lower bound of the bracket, upper bound of the bracket, expected relative approximation error, and max iteration. The function should return the approximate value of the root.

- Modify the above method (as a second function/program) to output a table showing the absolute relative approx. error after each iteration of the bisection method for up to 20 iterations.