Bisection Method for Divisor Method Apportioning

The *bisection method* is a method for finding the x value where a function equals a specific y value. We will use it for our apportionment problems that we want to use divisor methods on. In these problems, the value of the divisor d is our x value and where the sum of the rounded quotas comes out to the specific correct y value. The different divisor methods (Jefferson's, Webster's, and the Hill Hamilton method) differ by the rounding technique used to compute the final quotas for a given divisor d. None of the methods specify how to guess a value of d that will make the sum come out correct value, call it T, at the end, however, but the bisection method can be used to calculate a value of d that works regardless of which divisor method you are using.

The method works as follows:

1. Start with two initial guesses for the correct d value: call them a_1 for the value that gives you a sum higher than T and b_1 for the value that gives you a sum lower than T. In our apportionment problems, one of these can be the standard divisor s, and if s gives you a sum that is too high, the other initial guess for d should give you a sum that is too low, and vice versa.

2. Using your two guesses for the correct d value, one of which is too high and the other of which is too low, find the midpoint of the two guesses by averaging them and this is your new guess. If your new guess is too high (so it gives you a sum that is too low), call it b_2, and if it is too low (so it gives you a sum that is too high), call it a_2.

3. Repeat the procedure in step two, always averaging an a (value that is too low) and a b (value that is too high) at each step, so that there is a correct value of d between the two guesses every time you average the points. Stop repeating when the sum with your value of d comes out to T, the correct value.