Binary Search of Table Data

### Overview ###  
Modified binary search algorithm that will search through a table and return either an exact found match or predicted value based on whether the target value is found inside of outside of the set.

1. Comparison of modified Binary Search (MBS) in iterative form and recursive form to test for efficiency
2. Employment of interpolated predictive methods and extrapolative predictive methods

### Purpose of Development and Possible Application ####

Developed since in engineering fields (like thermodynamics or aerodynamics) tabulated data is a critical component in the process to a solution where you take the value of one feature (ie: altitude) and find the value of another feature (ie: air density). Sometimes the value that an engineer is searching for is an exact match to a value in the table, but most of the time this target value exists between two table values and interpolation must be used to find corresponding feature values of the target value.

Binary Search is the fastest search algorithm for a sorted table, but it only returns a single, exact value. Thus, in order to be applicable to engineering ‘look-up’ tables, the algorithm must be modified to find the indexes of the table values above and below the target in order to perform a form of value prediction for all the corresponding feature values.

This modified binary search algorithm can be used in many application of computation engineering simulations, such as CFDs, or for basic engineering calculations in order to reduce the overall time to find the correct value and given another value, and thus improve the time efficiency and reduce the computational cost of the solution model.

### Dependencies ####

Pandas

#### Description of Search ####

Recursive Binary Search

### Key Variables ####

Out

### Future Work ####

1. Comparison to regression methods using the entire population of the tabulated data in both accuracy and efficiency
2. Extension of the interpolated methods where a radius of index (whole number) can be an attribute in the function to control the sample size of the population used in the prediction
   1. Ex: with a radius of 1, take the first table value above the target and the first table value below the target
   2. Ex: with a radius of 3, take the first 3 table values above the target and the first 3 values below the target
3. Further extension of interpolation could be an offset of origin of the target value in relation to radius
   1. Ex: with a radius of 3 and an offset of 1, take the first 4 table values above target and the first 2 table values below the target