**General Overview**

SpecSheet - UnresVariableAppraisal.xlsx: A description of the required inputs and outputs for the RAT-STATS unrestricted variable appraisal module.

Examples - UnresVariableAppraisal.xlsx: Two example RAT-STAT inputs for the variable appraisal module.

tvalueTable.csv: An example of a table with t-values for a fixed set of confidence levels.

VBCode - UnresVariableAppraisal.xlsm: Macro that replicates the RAT-STATS implementation of the unrestricted attribute appraisal module.

Also refer to pages 110 through 115 (sections 3-2 through 3-7) in the RAT-STATS 2010 Companion Manual and pages 188 through 201 (sections 4-5 through 4-18) of the RAT-STATS 2010 User Manual. Both documents can be found on the following page <https://oig.hhs.gov/compliance/rat-stats/>. The data limitations associated with RAT-STATS can be found on pages 386 through 393 (A-1 through B-5) of the RAT-STATS 2010 User Guide.

**Exception Checking**

Your program does not need to provide the exact same error messages as RAT-STATS, but exceptions handled by RAT-STATS must be handled by your submissions as well. Exceptions will be checked through the use of test datasets.

**Calculating the Target t-value**

RAT-STATS calculates the t-value given the degrees of freedom (the sample size minus 1) and the target confidence level. Some, but not all, programming languages have libraries that allow for the direct calculation of the t-value. If such a command is not available, you will need to program your own t-score calculator. There are several ways to do this.

One approach is to solve the equation *F(q) - u* = 0 for *q*. Where *u* is the target confidence level and *F(q)* is the cumulative distribution function, and *q* is the t-value where the CDF equals the target confidence level. The obstacle in this approach is that the CDF for the *t*-distribution is difficult to calculate directly due to the factorials involved. Nevertheless, the calculation is possible and there is significant literature on the topic. On implementation of this function can be found in the accompanying file “VBCode - UnresVariableAppraisal.xlsm”.

Another approach is to create a lookup table using a separate software package (e.g. R or SAS) and then refer to the lookup table to identify the t-value for any given degrees of freedom. This approach is inefficient since the table would need to contain all possible t-values from 1 to the maximum sample size minus 1 for each possible confidence level. A draft demonstration of such a table is provided in this folder (see, “tvalueTable.csv”).

Rather than calculate the inverse CDF numerically, there are several methods such as the Cornish-Fisher expansions that provide rough approximations. These methods should be avoided since they will lead to upper and lower limits that do not match the output of the original RAT-STATS software.

**Types of Data (Examined, Audited, and Difference Values)**

The current version of RAT-STATS allows for the user to input the audited, difference, or examined amounts. The difference amounts equal the audited amounts minus the examined amounts. Consequently, given any combination of the two values it is possible to calculate the third. In fact, when the data input into RAT-STATS includes two values, it automatically calculates and provides a statistical estimate for the third amount. For example, given the audited and examined amounts RAT-STATS will subtracted the examined from the audited and also report the difference amounts.

It is not necessary to replicate this exact feature of RAT-STATS as long as there is a way to replicate the resulting estimates. If this feature is not included, be sure to document the steps required to replicate the RAT-STATS results, and include this documentation when you make your submission.