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The Minimum Accuracy Value as an Index of Classification Accuracy

The minimum accuracy value is a way of representing more of the information contained in an accuracy test by indicating not only whether the map passed or failed but also how well it passed or failed the test.

Introduction

As remote sensing applications have been developed to meet a variety of mapping information needs, methods of assessing the interpretation results have been required. In two previous articles (Aronoff, 1982a, 1982b) the author reviewed the theory of classification accuracy assessment, and some of the recent work in this field, and proposed a report format for classification accuracy tests. The principal objective of the report format was to present test data in a disaggregated form so that individual users could interpret the results as appropriate for their own specific applications. It was also proposed that, in addition to reporting whether a thematic map had passed or failed a specific accuracy test, a minimum accuracy value should be calculated for each map class. The minimum accuracy value (based on the binomial distribution) is a statistical measure of quality whereas the simple yes/no answer of a hypothesis test only considers whether the map has exceeded a threshold level.

This paper illustrates the use of minimum accuracy values in assessing the classification of remotely sensed data. Minimum accuracy values for a range of accuracy test designs are provided in a format that allows the user to both design an accuracy assessment test and evaluate the test results.

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Abstract: *The minimum accuracy value is defined as the lowest expected accuracy of a thematic map given an observed accuracy test result and the user selected consumer risk. Because a measure of the level of uncertainty is incorporated into the minimum accuracy value, it is a useful index to compare the results of accuracy tests using different sample sizes and for use in a loss function for comparing the relative expected maximum cost of alternative classification methods.*

Tables provide the data needed to select a classification accuracy test at the 80 percent, 85 percent, or 90 percent level, at consumer risks of 0.01, 0.05, and 0.10, and give the minimum accuracy values for a range of test results.

Map Accuracy Testing

One method to test whether a map class is of acceptable accuracy is to select s sample of map points, check the map classification against ground data, and then make a statement about the true accuracy of the map. Such a statement generally claims some minimum level of accuracy with some high level of confidence, e.g., a minimum of 85 percent accuracy at the 95 percent confidence level. The sampling problem is then one of determining the number (N) of map samples to be compared with ground data, and an allowable number of misclassifications (X) of these samples. After these values are determined, N map samples are selected and their classifications are compared against the true classification of the sample point (e.g., ground data). If X or fewer points are misclassified, then the map is accepted as accurate at the specified level of precision. (It is assumed that misclassification of a site can be unambiguously determined.)

In any statistical test there is a probability or risk that interpretation of the test results will lead to the wrong conclusion. The probabilities associated with the two types of erroneous conclusions may be termed consumer risk and producer risk. (Aronoff (1982a) showed that the consumer and producer risks as defined below could become either the Type I or Type II statistical error, depending on the way the null hypothesis is contructed. By using the terms consumer and producer risks, the confusion is avoided.)

Photogrammetric Engineering and Remote Sensing,
Vol. 51, No. 1, January 1985, pp. 99-111.

0099-1112/85/5101-0099$02.25/0

Consumer risk is the probability that a map of unacceptable accuracy will pass the accuracy test. It can be calculated from the binomial sampling distribution as follows:

$$\text{CRISK} = \sum_{Y=0}^{X} \frac{N!}{Y!(N-Y)!} Q_L^{(N-Y)} (1 - Q_L)^Y \quad (1)$$

where CRISK = consumer risk,
Q_L = the minimum accuracy required,
X = number of allowable misclassifications,
N = total number of points sampled, and
Y = number of misclassifications.

The producer risk is the probability that a map of some acceptable accuracy Q_H will be rejected and is calculated as follows:

$$\text{PRISK} = \sum_{Y=X+1}^{N} Q_H^{(N-Y)} (1 - Q_H)^Y \quad (2)$$

where PRISK = producer risk and
Q_H = a selected high accuracy level

The selection of values for consumer and producer risks depend on the value of the information and cost errors in a specific application.

Minimum Accuracy Value

A hypothesis test leads to the conclusion that either the map is sufficiently accurate or it is not, depending on whether it passed or failed the test. However, a map which fails to pass a test for 85 percent accuracy might still be adequate for a user requiring only 80 percent accuracy. The minimum accuracy value is a measure of quality obtained by calculating the accuracy of the map which would give the observed test results, given the specified consumer risk. (Producer risk is already specified by the sample size selected.)

The minimum accuracy value is the highest accuracy level (Q_L) for which the observed number of misclassifications (Y) would constitute passing an accuracy test at the user specified consumer risk (CRISK). It is a probabilistic estimate of the minimum expected accuracy of a thematic map class. It is calculated from Equation 1, by setting X to the observed number of misclassifications, N to the sample size used, and CRISK is set to the consumer risk used in designing the accuracy test. The author developed a computer program to iteratively find a value of Q_L which satisfies the equation. The minimum accuracy value can be interpreted to be that accuracy level which is so low that there is only a small chance (the consumer risk) that the test results could be as good as those observed when the true map accuracy was less than the minimum accuracy value.

The reason for calculating this conservative accuracy value is that it is a measure which takes into account the degree of uncertainty of the estimate. Using a consumer risk of 0.05, a test result of 90 percent correct for a sample size of 100 has a minimum accuracy of 83.6 percent whereas, for a sample size of 10, the minimum accuracy value is 60.5 percent. The minimum accuracy value, by reflecting the level of uncertainty related to sample size, is a useful index for comparing accuracy test results in which the sample sizes are different.

Another application of the minimum accuracy value is in the construction of a loss function. Subtracting the minimum accuracy value from 100 percent gives the complement that can be considered the maximum expected error. In the case of classifying Landsat imagery, the misclassification or incorrect assignment of a pixel to a specific class can be assigned a cost. Then the maximum expected loss for the class can be calculated as follows:

$$ML_i = \frac{(100\% - MINAC_i)C_iN_i}{100} \quad (3)$$

where C_i = cost of misclassifying a pixel in class i,
ML_i = maximum expected loss for class i,
$MINAC_i$ = minimum accuracy for class i, and
n_i = accuracy test sample size for class i.

The maximum expected loss for an entire thematic map, e.g., the classification of a Landsat image, can be calculated by summing the maximum expected values for each class; i.e.,

$$ML = \sum_{i=1}^{I} ML_i \quad (4)$$

where ML = the maximum expected loss over all I classes and
ML_i = expected loss for class i.

The maximum expected loss values can be then used as an index to compare the relative cost of using different classification algorithms or mapping systems. Aronoff (1983) showed how the method could be used to compare alternative environmental planning systems. Aronoff (1984) showed how the maximum expected loss could be used to optimize the labeling of image classes from an unsupervised classification.

Sample Selection

Techniques of sample selection for thematic map accuracy assesssment have been discussed by van Genderen et. al. (1978) and Rosenfeld et. al. (1982). Some important considerations are noted below. A more complete discussion of sampling theory can be found in Raj (1972).

A random sample of test points selected from a thematic map is area weighted, and therefore,

classes of small areal extent are often not sampled at all. For this reason it is generally accepted that some form of stratified sampling should be used, thereby ensuring that each map class is adequately tested (van Genderen et. al., 1978). Depending on the geographic location and study size, the shape and size of individual map polygons may show significant trends. A wet meadow class, for example, may occur as long, thin polygons in the more mountainous areas of the map and as broader and larger polygons in more level terrain. Classification errors, especially those related to boundary errors, will tend to be greater for the long thin polygons. A stratified random sample is generally not distributed evenly over the map area; thus, if the less accurately mapped smaller polygons are concentrated in one region of the map, they may be missed.

A systematic sampling method can be used to ensure that polygons of the class are sampled from all areas of the map. If the spatial arrangement of the sampled polygons is random, then the systematic sample should give rise to point and variance estimates similar to those resulting from a simple random sample (Raj, 1972). However, thematic map polygons commonly show some form of clumped distribution (e.g., urban areas) or regular distribution (e.g., parallel streams along scarps). If the distribution of polygons trends in a direction parallel to the transects of the systematic sample, a significant bias may be introduced. A single (one direction) or double (two directions) unaligned systematic sample can be used to eliminate this bias (Quenouille, 1949; Thomas, 1975).

The choice of sampling technique will depend on several factors, including the size of the study area, the type and distribution of features being mapped, the cost of acquiring verification data, and the funds for the accuracy assessment.

Size of Sample Units

Though a sample unit for accuracy verification is often considered to be a point for theoretical purposes, in practice a point cannot be accurately verified because the locational accuracy of the mapping system will have some error and in practice the "point" is a small sample unit such as a single pixel that may be too small to accurately locate on the ground. The size of the sample unit to be centered on the selected test point should, therefore, be large enough that a point on the map will be included within the sample unit on the ground (or other verification data) with some acceptable level of confidence. The sample unit should also be at least as large as the minimum mapping unit; otherwise, the thematic map will be tested at a level of resolution it was not designed to meet.

Because the sample units occupy an area, they can contain more than one map class. These mixed units can be handled in several ways. A plurality rule can be used to assign the test site to the class of greatest abundance. More complex methods could also be used that utilize measures of correspondence between the proportion of each map class occurring in the test site as mapped and the proportion as obtained from verification data. The decision rule selected will depend on the specific case and the cost of the different procedures.

Use of the Minimum Accuracy Tables

Tables A1 to A9 in the Appendix list classification accuracy test designs, their associated consumer risks, and producer risks for three levels of accuracy.

Each table lists the sample size (N)*, and exact consumer risk (CRISK), for critical values (X), i.e., the maximum allowable misclassifications, ranging from 0 to 35. The values for each table are calculated for a test at a specific level of accuracy: 80 percent, 85 percent, or 90 percent, and at a specified maximum consumer risk of 1 percent, 5 percent, or 10 percent. The first six columns of each table are for accuracy test design, and the remaining columns are for interpretation of the test results.

Test Design

The use of a stratified sampling method is advocated, and in the remainder of the paper accuracy test design and evaluation is illustrated using a single map class. Evaluation of the entire map would require that each map class be evaluated separately.

Accuracy test design requires that an accuracy level and consumer risk be selected. The values of these parameters will depend on the specific application, the cost of unknowingly using an unacceptable map, and the cost of performing the accuracy test. As the cost of misclassifications becomes higher, the consumer risk, i.e., the chance of erroneously accepting a substandard map, should be set lower. Suppose that an accuracy level of 85 percent and a consumer risk of 0.05 are considered appropriate to test a specified map class, then Table A5 can be used to design the accuracy test. For each critical value in the table, the smallest sample size which satisfies the specified consumer risk criterion has been calculated. The choice of sample size depends on the level of producer risk considered acceptable.

Producer risks have been tabulated for map accuracies of 90 percent, 95 percent, and 99 percent. The least expensive accuracy test to perform would use the smallest sample size, in this case 19 points. However, the producer risk for a class that has been mapped with an accuracy of 95 percent would be 0.6226. That is, if a class mapped with 95 percent

* The binomial distribution is discrete. As a result, there will be more than one sample size (N) which will have the same associated number of allowable misclassifications (X) for a given maximum allowable consumer risk. The smallest value of N which satisfies these two constraints is considered optimal because it also minimizes the producer risk (Ginevan, 1979).

accuracy were repeatedly tested by selecting 19 points for verification, it would fail the test approximately 62 percent of the time. This high producer risk has a cost; the cost of unnecessarily re-checking a sufficiently accurate map and the cost of the delay in providing the information to the user. Using a larger sample size reduces the producer risk. From Table A5, using a sample size of 93 reduces the producer risk for a class mapped with an accuracy of 95 percent to 0.0432. This reduces the chance and therefore the cost of incorrectly rejecting an accurate map, but increases the cost of performing the test because a larger sample size is used. The appropriate balance between cost of testing, the cost of accepting an unacceptable map, and the cost of erroneously rejecting an accurate map should be determined by the user in relation to the specific application of the information.

Evaluating the Test Results

An accuracy test can be designed as outlined above and then implemented. The results of the accuracy test can then be evaluated in two ways. The test can be used as a hypothesis test, in which case the map is rejected if more than the allowable number of misclassifications are obtained. In addition, the accuracy test results can be used to calculate an index of quality, in this case a minimum accuracy value, as illustrated below.

Suppose that for an accuracy test 10 out of 93 points were incorrectly classified. Because the critical value '8' from Table A5 was exceeded, the map failed the test. The deviation of the result from X is the observed misclassifications minus the critical value or $10 - 8 = 2$. The minimum accuracy value for a sample size $N = 93$ and deviation of 2 is 82.4 percent. In other words, there is a chance (consumer risk) of only 5 percent or less that a map with an accuracy level as low as 82.4 percent would give a test result as good as ten misclassifications out of 93 sampled points. Odd numbered deviations can be estimated from the table by graphical interpolation. (A plot can be made of minimum accuracy versus number of misclassifications for the row being used in the tables. Because each row produces a different curve, they have not been included here.) As N increases, the relationship between minimum accuracy and deviations from X approaches linearity; and for $N = 50$ or larger, linear interpolation may be sufficiently accurate.

The minimum accuracy value, used as a measure of quality, can guide the user in deciding whether a particular thematic map, such as is commonly generated from remotely sensed data, is suitable for a specific application.

Conclusion

Classification accuracy tests can be designed as hypothesis tests in which the criterion for accepting a map or map class is that it passes the test. A useful measure of quality is the minimum accuracy value, i.e., the lowest accuracy the map is expected to have given the observed test results and the selected consumer risk. The minimum accuracy value is a way of representing more of the information contained in an accuracy test by indicating not only whether the map passed or failed but also how well it passed or failed the test.

The tables provide the data necessary both to select a classification accuracy test and to interpret the results. When the data from accuracy tests are presented in a disaggregated form such as an error matrix, the user can evaluate the suitability of the map product for a specific application. The tables included here can be used to evaluate accuracy test data and help the user make that evaluation.

Acknowledgments

The review of the manuscript by Andrew Benson and Randall Thomas of the Remote Sensing Research Program, University of California, Berkeley, is gratefully acknowledged. This research was supported in part by the Department of Forestry and the Space Sciences Laboratory, University of California, Berkeley.

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(Received 18 August 1982; revised and accepted 15 July 1984)

Appendix

Table A1. Critical Value Table for a Required Accuracy of 80.0% with a Consumer Risk of 0.01

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X															
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	21	0.0092	0.8906	0.6594	0.1903	****	****	****	80.2	65.5	54.0	43.8	34.7	26.4	18.8	12.2	6.5	2.1	0.0	****	****	****
1	31	0.0087	0.8304	0.4634	0.0384	****	****	****	80.4	71.0	62.9	55.5	48.6	42.1	35.9	30.1	24.5	19.3	14.5	10.0	6.0	2.7
2	39	0.0095	0.7622	0.3094	0.0070	****	****	88.8	80.1	73.0	66.5	60.5	54.8	49.4	44.2	39.2	34.4	29.8	25.3	21.0	17.0	13.1
3	47	0.0093	0.7044	0.2074	0.0013	****	****	86.6	80.1	74.4	69.1	64.0	59.2	54.6	50.1	45.8	41.6	37.5	33.5	29.7	25.9	22.3
4	55	0.0087	0.6549	0.1397	0.0002	****	91.9	85.5	80.3	75.5	70.9	66.6	62.5	58.5	54.6	50.7	47.0	43.4	39.9	36.4	33.0	29.7
5	62	0.0090	0.5957	0.0891	0.0000	****	89.7	84.6	80.1	76.0	72.0	68.2	64.5	60.9	57.4	53.9	50.6	47.3	44.1	40.9	37.8	34.8
6	69	0.0092	0.5425	0.0567	0.0000	93.5	88.3	84.0	80.1	76.4	72.9	69.4	66.1	62.9	59.7	56.6	53.5	50.5	47.6	44.7	41.8	39.0
7	76	0.0091	0.4945	0.0360	0.0000	91.5	87.3	83.6	80.1	76.8	73.6	70.5	67.5	64.5	61.6	58.8	56.0	53.2	50.5	47.8	45.2	42.6
8	83	0.0089	0.4514	0.0229	0.0000	90.2	86.6	83.3	80.1	77.1	74.2	71.4	68.6	65.9	63.2	60.6	58.0	55.5	53.0	50.5	48.0	45.6
9	89	0.0098	0.3986	0.0135	0.0000	89.1	85.9	82.9	80.0	77.2	74.5	71.9	69.3	66.8	64.3	61.8	59.4	57.0	54.6	52.3	50.0	47.7
10	96	0.0093	0.3642	0.0086	0.0000	88.3	85.4	82.7	80.1	77.5	75.0	72.6	70.2	67.8	65.5	63.2	61.0	58.7	56.6	54.4	52.2	50.1
11	103	0.0089	0.3333	0.0054	0.0000	87.7	85.1	82.6	80.1	77.8	75.5	73.2	71.0	68.8	66.6	64.5	62.4	60.3	58.2	56.2	54.2	52.2
12	109	0.0094	0.2939	0.0032	0.0000	87.1	84.7	82.3	80.0	77.8	75.6	73.5	71.4	69.3	67.3	65.3	63.3	61.3	59.3	57.4	55.5	53.6
13	115	0.0099	0.2588	0.0019	0.0000	86.6	84.3	82.1	80.0	77.9	75.8	73.8	71.8	69.9	67.9	66.0	64.1	62.2	60.4	58.5	56.7	54.9
14	122	0.0092	0.2372	0.0012	0.0000	86.2	84.1	82.1	80.1	78.1	76.2	74.3	72.4	70.6	68.7	66.9	65.1	63.4	61.6	59.9	58.1	56.4
15	128	0.0096	0.2088	0.0007	0.0000	85.8	83.8	81.9	80.0	78.1	76.3	74.5	72.7	71.0	69.2	67.5	65.8	64.1	62.4	60.8	59.1	57.5
16	134	0.0099	0.1836	0.0004	0.0000	85.5	83.6	81.8	80.0	78.2	76.5	74.7	73.0	71.4	69.7	68.0	66.4	64.8	63.2	61.6	60.0	58.4
17	141	0.0091	0.1687	0.0003	0.0000	85.3	83.5	81.8	80.1	78.4	76.7	75.1	73.5	71.9	70.3	68.8	67.2	65.7	64.1	62.6	61.1	59.6
18	147	0.0093	0.1483	0.0001	0.0000	85.0	83.3	81.7	80.0	78.4	76.9	75.3	73.7	72.2	70.7	69.2	67.7	66.2	64.8	63.3	61.9	60.4
19	153	0.0095	0.1303	0.0001	0.0000	84.7	83.1	81.6	80.0	78.5	77.0	75.5	74.0	72.5	71.1	69.6	68.2	66.8	65.4	64.0	62.6	61.2
20	159	0.0097	0.1145	0.0000	0.0000	84.5	83.0	81.5	80.0	78.5	77.1	75.6	74.2	72.8	71.4	70.0	68.6	67.3	65.9	64.5	63.2	61.9
21	165	0.0098	0.1005	0.0000	0.0000	84.3	82.8	81.4	80.0	78.6	77.2	75.8	74.4	73.1	71.7	70.4	69.0	67.7	66.4	65.1	63.8	62.5
22	171	0.0099	0.0882	0.0000	0.0000	84.1	82.7	81.3	80.0	78.6	77.3	75.9	74.6	73.3	72.0	70.7	69.4	68.2	66.9	65.6	64.4	63.1
23	178	0.0091	0.0814	0.0000	0.0000	84.0	82.7	81.4	80.1	78.8	77.5	76.2	74.9	73.7	72.4	71.2	69.9	68.7	67.5	66.3	65.1	63.9
24	184	0.0091	0.0714	0.0000	0.0000	83.9	82.6	81.3	80.0	78.8	77.5	76.3	75.1	73.9	72.7	71.5	70.3	69.1	67.9	66.7	65.6	64.4
25	190	0.0092	0.0627	0.0000	0.0000	83.8	82.5	81.3	80.0	78.8	77.6	76.4	75.3	74.1	72.9	71.7	70.6	69.4	68.3	67.2	66.0	64.9
26	196	0.0092	0.0550	0.0000	0.0000	83.6	82.4	81.2	80.0	78.9	77.7	76.5	75.4	74.3	73.1	72.0	70.9	69.8	68.7	67.6	66.5	65.4
27	202	0.0092	0.0483	0.0000	0.0000	83.5	82.3	81.2	80.0	78.9	77.8	76.7	75.5	74.4	73.3	72.3	71.2	70.1	69.0	68.0	66.9	65.8
28	208	0.0092	0.0424	0.0000	0.0000	83.4	82.3	81.1	80.0	78.9	77.8	76.8	75.7	74.6	73.5	72.5	71.4	70.4	69.3	68.3	67.3	66.2
29	214	0.0092	0.0372	0.0000	0.0000	83.3	82.2	81.1	80.0	79.0	77.9	76.9	75.8	74.8	73.7	72.7	71.7	70.7	69.7	68.6	67.6	66.6
30	219	0.0099	0.0309	0.0000	0.0000	83.1	82.1	81.0	80.0	78.9	77.9	76.9	75.8	74.8	73.8	72.8	71.8	70.8	69.8	68.8	67.9	66.9
31	225	0.0099	0.0271	0.0000	0.0000	83.0	82.0	81.0	80.0	78.9	77.9	76.9	76.0	75.0	74.0	73.0	72.0	71.1	70.1	69.1	68.2	67.2
32	231	0.0098	0.0237	0.0000	0.0000	83.0	81.9	81.0	80.0	79.0	78.0	77.0	76.1	75.1	74.2	73.2	72.3	71.3	70.4	69.4	68.5	67.6
33	237	0.0097	0.0208	0.0000	0.0000	82.9	81.9	80.9	80.0	79.0	78.1	77.1	76.2	75.2	74.3	73.4	72.5	71.5	70.6	69.7	68.8	67.9
34	243	0.0097	0.0182	0.0000	0.0000	82.8	81.9	80.9	80.0	79.0	78.1	77.2	76.3	75.4	74.5	73.6	72.7	71.8	70.9	70.0	69.1	68.2
35	249	0.0096	0.0160	0.0000	0.0000	82.7	81.8	80.9	80.0	79.1	78.2	77.3	76.4	75.5	74.6	73.7	72.9	72.0	71.1	70.2	69.4	68.5

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A2. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 80.0% WITH A CONSUMER RISK OF 0.05

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X															
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	14	0.0440	0.7712	0.5123	0.1313	****	****	****	80.7	61.4	46.0	32.5	20.6	10.4	2.6	0.0	****	****	****	****	****	****
1	22	0.0480	0.6608	0.3018	0.0202	****	****	****	80.1	68.4	58.0	48.4	39.5	31.1	23.2	15.9	9.4	3.8	0.2	****	****	****
2	30	0.0442	0.5886	0.1878	0.0033	****	****	90.4	80.4	72.0	64.3	57.0	50.0	43.3	36.9	30.8	24.9	19.3	14.0	9.0	4.6	1.1
3	37	0.0450	0.5136	0.1119	0.0005	****	****	87.8	80.3	73.6	67.3	61.3	55.6	50.0	44.6	39.3	34.2	29.3	24.5	19.9	15.4	11.2
4	44	0.0440	0.4528	0.0675	0.0001	****	93.4	86.3	80.3	74.8	69.5	64.5	59.5	54.8	50.1	45.5	41.1	36.7	32.5	28.3	24.3	20.3
5	50	0.0480	0.3839	0.0378	0.0000	****	90.8	85.2	80.1	75.3	70.6	66.2	61.8	57.6	53.4	49.3	45.4	41.4	37.6	33.8	30.1	26.5
6	57	0.0451	0.3429	0.0231	0.0000	94.8	89.3	84.6	80.2	76.1	72.0	68.1	64.3	60.5	56.8	53.2	49.6	46.1	42.6	39.2	35.9	32.6
7	63	0.0473	0.2927	0.0130	0.0000	92.6	88.1	84.0	80.1	76.3	72.7	69.2	65.7	62.3	58.9	55.6	52.3	49.1	46.0	42.8	39.7	36.7
8	69	0.0490	0.2502	0.0073	0.0000	91.1	87.2	83.5	80.0	76.6	73.3	70.1	66.9	63.8	60.7	57.6	54.6	51.7	48.8	45.9	43.0	40.2
9	76	0.0450	0.2262	0.0045	0.0000	90.1	86.6	83.3	80.2	77.1	74.1	71.2	68.3	65.5	62.7	59.9	57.1	54.4	51.7	49.1	46.5	43.9
10	82	0.0458	0.1943	0.0026	0.0000	89.1	86.0	83.0	80.1	77.3	74.6	71.8	69.2	66.5	63.9	61.3	58.8	56.2	53.7	51.3	48.8	46.4
11	88	0.0464	0.1671	0.0014	0.0000	88.4	85.5	82.8	80.1	77.5	74.9	72.4	69.9	67.4	65.0	62.6	60.2	57.8	55.5	53.2	50.9	48.6
12	94	0.0468	0.1438	0.0008	0.0000	87.7	85.1	82.6	80.1	77.7	75.3	72.9	70.6	68.2	66.0	63.7	61.5	59.2	57.0	54.9	52.7	50.5
13	100	0.0469	0.1239	0.0005	0.0000	87.2	84.8	82.4	80.1	77.8	75.6	73.3	71.1	69.0	66.8	64.7	62.6	60.5	58.4	56.3	54.3	52.3
14	106	0.0469	0.1068	0.0003	0.0000	86.7	84.5	82.3	80.1	77.9	75.8	73.7	71.7	69.6	67.6	65.6	63.6	61.6	59.6	57.7	55.7	53.8
15	112	0.0467	0.0922	0.0001	0.0000	86.3	84.2	82.1	80.1	78.1	76.1	74.1	72.1	70.2	68.3	66.4	64.5	62.6	60.7	58.9	57.0	55.2
16	118	0.0464	0.0796	0.0001	0.0000	86.0	84.0	82.0	80.1	78.2	76.3	74.4	72.6	70.7	68.9	67.1	65.3	63.5	61.7	60.0	58.2	56.5
17	124	0.0460	0.0689	0.0000	0.0000	85.7	83.8	81.9	80.1	78.3	76.5	74.7	72.9	71.2	69.5	67.7	66.0	64.3	62.6	61.0	59.3	57.6
18	129	0.0496	0.0559	0.0000	0.0000	85.3	83.5	81.7	80.0	78.2	76.5	74.8	73.1	71.4	69.8	68.1	66.5	64.8	63.2	61.6	60.0	58.4
19	135	0.0490	0.0484	0.0000	0.0000	85.1	83.4	81.7	80.0	78.3	76.7	75.1	73.4	71.8	70.2	68.7	67.1	65.5	64.0	62.4	60.9	59.3
20	141	0.0483	0.0419	0.0000	0.0000	84.9	83.2	81.6	80.0	78.4	76.9	75.3	73.8	72.2	70.7	69.2	67.7	66.2	64.7	63.2	61.7	60.2
21	147	0.0475	0.0363	0.0000	0.0000	84.7	83.1	81.6	80.0	78.5	77.0	75.5	74.0	72.6	71.1	69.7	68.2	66.8	65.3	63.9	62.5	61.1
22	153	0.0467	0.0314	0.0000	0.0000	84.5	83.0	81.5	80.1	78.6	77.2	75.7	74.3	72.9	71.5	70.1	68.7	67.3	65.9	64.6	63.2	61.8
23	158	0.0496	0.0255	0.0000	0.0000	84.3	82.8	81.4	80.0	78.6	77.2	75.8	74.4	73.0	71.7	70.3	69.0	67.6	66.3	65.0	63.7	62.3
24	164	0.0487	0.0221	0.0000	0.0000	84.1	82.7	81.4	80.0	78.6	77.3	76.0	74.6	73.3	72.0	70.7	69.4	68.1	66.8	65.6	64.3	63.0
25	170	0.0478	0.0192	0.0000	0.0000	84.0	82.7	81.3	80.0	78.7	77.4	76.1	74.9	73.6	72.3	71.1	69.8	68.6	67.3	66.1	64.9	63.6
26	176	0.0468	0.0167	0.0000	0.0000	83.9	82.6	81.3	80.1	78.8	77.5	76.3	75.1	73.9	72.6	71.4	70.2	69.0	67.8	66.6	65.4	64.2
27	181	0.0493	0.0135	0.0000	0.0000	83.7	82.4	81.2	80.0	78.8	77.5	76.3	75.1	74.0	72.8	71.6	70.4	69.2	68.1	66.9	65.8	64.6
28	187	0.0483	0.0117	0.0000	0.0000	83.6	82.4	81.2	80.0	78.8	77.7	76.5	75.3	74.2	73.0	71.9	70.8	69.6	68.5	67.4	66.2	65.1
29	193	0.0472	0.0102	0.0000	0.0000	83.5	82.3	81.2	80.0	78.9	77.8	76.6	75.5	74.4	73.3	72.2	71.1	70.0	68.9	67.8	66.7	65.6
30	198	0.0495	0.0083	0.0000	0.0000	83.3	82.2	81.1	80.0	78.9	77.8	76.7	75.6	74.5	73.4	72.3	71.2	70.2	69.1	68.0	67.0	65.9
31	204	0.0483	0.0072	0.0000	0.0000	83.3	82.2	81.1	80.0	78.9	77.9	76.8	75.7	74.7	73.6	72.6	71.5	70.5	69.5	68.4	67.4	66.4
32	210	0.0472	0.0062	0.0000	0.0000	83.2	82.1	81.1	80.0	79.0	78.0	76.9	75.9	74.9	73.8	72.8	71.8	70.8	69.8	68.8	67.8	66.8
33	215	0.0493	0.0051	0.0000	0.0000	83.1	82.0	81.0	80.0	79.0	77.9	76.9	75.9	74.9	73.9	72.9	72.0	71.0	70.0	69.0	68.0	67.1
34	221	0.0481	0.0044	0.0000	0.0000	83.0	82.0	81.0	80.0	79.0	78.0	77.1	76.1	75.1	74.1	73.2	72.2	71.3	70.3	69.3	68.4	67.4
35	227	0.0470	0.0038	0.0000	0.0000	82.9	82.0	81.0	80.0	79.1	78.1	77.2	76.2	75.3	74.3	73.4	72.5	71.5	70.6	69.7	68.7	67.8

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A3. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 80.0% WITH A CONSUMER RISK OF 0.10

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	11	0.0859	0.6862	0.4312	0.1047	****	****	****	81.1	58.4	40.0	24.0	10.4	0.9	****	****	****	****	****	****	****	****
1	18	0.0991	0.5497	0.2265	0.0138	****	****	****	80.0	66.5	54.5	43.3	32.8	23.1	14.1	6.2	0.5	****	****	****	****	****
2	25	0.0982	0.4629	0.1271	0.0020	****	****	91.2	80.0	70.5	61.6	53.2	45.2	37.5	30.1	23.0	16.3	10.0	4.4	0.4	****	****
3	32	0.0931	0.3997	0.0738	0.0003	****	****	88.3	80.3	72.9	65.9	59.2	52.7	46.5	40.4	34.4	28.7	23.1	17.7	12.6	7.8	3.4
4	38	0.0986	0.3299	0.0397	0.0000	****	94.1	86.5	80.0	73.9	68.0	62.3	56.8	51.4	46.2	41.0	36.0	31.0	26.2	21.5	17.0	12.6
5	45	0.0902	0.2923	0.0239	0.0000	****	91.6	85.7	80.3	75.2	70.2	65.4	60.7	56.1	51.5	47.1	42.7	38.4	34.2	30.0	25.9	21.9
6	51	0.0923	0.2452	0.0131	0.0000	95.5	89.9	84.9	80.2	75.7	71.4	67.1	62.9	58.8	54.8	50.8	46.9	43.0	39.2	35.4	31.7	28.1
7	57	0.0934	0.2066	0.0072	0.0000	93.3	88.6	84.3	80.2	76.2	72.3	68.5	64.7	61.0	57.4	53.8	50.2	46.7	43.3	39.9	36.5	33.1
8	63	0.0937	0.1748	0.0040	0.0000	91.7	87.7	83.8	80.1	76.6	73.0	69.6	66.2	62.8	59.5	56.3	53.0	49.8	46.7	43.5	40.4	37.3
9	69	0.0934	0.1484	0.0022	0.0000	90.5	86.9	83.5	80.1	76.9	73.7	70.5	67.4	64.4	61.3	58.3	55.3	52.4	49.5	46.6	43.7	40.9
10	75	0.0928	0.1263	0.0012	0.0000	89.6	86.3	83.2	80.2	77.2	74.2	71.3	68.5	65.6	62.8	60.1	57.3	54.6	51.9	49.2	46.6	43.9
11	81	0.0918	0.1077	0.0007	0.0000	88.8	85.8	83.0	80.2	77.4	74.7	72.0	69.4	66.8	64.2	61.6	59.0	56.5	54.0	51.5	49.0	46.5
12	86	0.0990	0.0858	0.0003	0.0000	88.0	85.3	82.6	80.0	77.4	74.8	72.3	69.8	67.4	64.9	62.5	60.1	57.7	55.3	52.9	50.6	48.3
13	92	0.0972	0.0735	0.0002	0.0000	87.5	84.9	82.5	80.0	77.6	75.2	72.9	70.5	68.2	65.9	63.7	61.4	59.2	56.9	54.7	52.5	50.3
14	98	0.0954	0.0630	0.0001	0.0000	87.0	84.7	82.3	80.1	77.8	75.6	73.4	71.2	69.0	66.9	64.7	62.6	60.5	58.4	56.3	54.2	52.2
15	104	0.0935	0.0541	0.0001	0.0000	86.6	84.4	82.2	80.1	78.0	75.9	73.8	71.8	69.7	67.7	65.7	63.7	61.7	59.7	57.7	55.7	53.8
16	109	0.0991	0.0432	0.0000	0.0000	86.2	84.1	82.0	80.0	78.0	76.0	74.0	72.0	70.1	68.1	66.2	64.3	62.4	60.5	58.6	56.7	54.9
17	115	0.0968	0.0372	0.0000	0.0000	85.9	83.9	81.9	80.0	78.1	76.2	74.4	72.5	70.6	68.8	67.0	65.2	63.4	61.6	59.8	58.0	56.2
18	121	0.0944	0.0321	0.0000	0.0000	85.6	83.7	81.9	80.1	78.3	76.5	74.7	72.9	71.2	69.4	67.7	66.0	64.2	62.5	60.8	59.1	57.4
19	126	0.0993	0.0256	0.0000	0.0000	85.3	83.5	81.7	80.0	78.2	76.5	74.8	73.1	71.4	69.7	68.1	66.4	64.8	63.1	61.5	59.9	58.2
20	132	0.0967	0.0221	0.0000	0.0000	85.1	83.4	81.7	80.0	78.4	76.7	75.1	73.5	71.9	70.3	68.7	67.1	65.5	63.9	62.4	60.8	59.3
21	138	0.0942	0.0191	0.0000	0.0000	84.9	83.3	81.7	80.1	78.5	76.9	75.4	73.8	72.3	70.8	69.2	67.7	66.2	64.7	63.2	61.7	60.2
22	143	0.0984	0.0153	0.0000	0.0000	84.6	83.1	81.5	80.0	78.5	77.0	75.5	74.0	72.5	71.0	69.5	68.1	66.6	65.2	63.7	62.3	60.8
23	149	0.0957	0.0132	0.0000	0.0000	84.5	83.0	81.5	80.0	78.6	77.1	75.7	74.3	72.8	71.4	70.0	68.6	67.2	65.8	64.4	63.0	61.6
24	154	0.0996	0.0106	0.0000	0.0000	84.2	82.8	81.4	80.0	78.6	77.2	75.8	74.4	73.0	71.6	70.3	68.9	67.5	66.2	64.9	63.5	62.2
25	160	0.0968	0.0092	0.0000	0.0000	84.1	82.7	81.4	80.0	78.7	77.3	76.0	74.6	73.3	72.0	70.7	69.4	68.1	66.8	65.5	64.2	62.9
26	166	0.0941	0.0080	0.0000	0.0000	84.0	82.7	81.4	80.1	78.8	77.5	76.2	74.9	73.6	72.3	71.1	69.8	68.6	67.3	66.0	64.8	63.6
27	171	0.0976	0.0064	0.0000	0.0000	83.8	82.5	81.3	80.0	78.7	77.5	76.2	75.0	73.7	72.5	71.3	70.1	68.8	67.6	66.4	65.2	64.0
28	177	0.0949	0.0055	0.0000	0.0000	83.7	82.5	81.3	80.0	78.8	77.6	76.4	75.2	74.0	72.8	71.6	70.4	69.3	68.1	66.9	65.7	64.6
29	182	0.0981	0.0044	0.0000	0.0000	83.6	82.4	81.2	80.0	78.8	77.6	76.5	75.3	74.1	73.0	71.8	70.7	69.5	68.4	67.2	66.1	64.9
30	188	0.0953	0.0039	0.0000	0.0000	83.5	82.3	81.2	80.0	78.9	77.8	76.6	75.5	74.4	73.2	72.1	71.0	69.9	68.8	67.7	66.6	65.5
31	193	0.0984	0.0031	0.0000	0.0000	83.3	82.2	81.1	80.0	78.9	77.8	76.7	75.6	74.5	73.4	72.3	71.2	70.1	69.0	67.9	66.9	65.8
32	199	0.0955	0.0027	0.0000	0.0000	83.3	82.2	81.1	80.0	78.9	77.9	76.8	75.7	74.7	73.6	72.6	71.5	70.5	69.4	68.4	67.3	66.3
33	204	0.0984	0.0022	0.0000	0.0000	83.2	82.1	81.0	80.0	78.9	77.9	76.8	75.8	74.8	73.7	72.7	71.7	70.6	69.6	68.6	67.6	66.6
34	210	0.0956	0.0019	0.0000	0.0000	83.1	82.1	81.0	80.0	79.0	78.0	77.0	76.0	75.0	74.0	73.0	72.0	71.0	70.0	69.0	68.0	67.0
35	215	0.0983	0.0015	0.0000	0.0000	83.0	82.0	81.0	80.0	79.0	78.0	77.0	76.0	75.0	74.1	73.1	72.1	71.1	70.2	69.2	68.2	67.3

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A4. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 85.0% WITH A CONSUMER RISK OF 0.0100

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	29	0.0090	0.9529	0.7741	0.2528	****	****	****	85.3	74.0	64.9	56.8	49.3	42.3	35.7	29.5	23.6	18.2	13.1	8.5	4.6	1.5
1	42	0.0091	0.9322	0.6276	0.0662	****	****	****	85.2	77.9	71.6	65.8	60.3	55.0	50.0	45.2	40.5	35.9	31.6	27.3	23.3	19.4
2	53	0.0097	0.9102	0.4982	0.0162	****	****	91.6	85.0	79.6	74.6	69.9	65.5	61.2	57.1	53.1	49.1	45.3	41.6	38.0	34.4	31.0
3	64	0.0092	0.8937	0.3986	0.0039	****	****	90.0	85.1	80.7	76.7	72.8	69.1	65.5	62.0	58.6	55.2	51.9	48.7	45.6	42.5	39.5
4	74	0.0094	0.8738	0.3112	0.0009	****	93.9	89.1	85.0	81.4	77.9	74.6	71.3	68.2	65.1	62.1	59.2	56.3	53.5	50.7	47.9	45.2
5	84	0.0092	0.8565	0.2434	0.0002	****	92.3	88.5	85.1	81.9	78.9	75.9	73.1	70.3	67.6	64.9	62.3	59.7	57.2	54.7	52.2	49.8
6	93	0.0097	0.8333	0.1839	0.0000	95.1	91.2	88.0	85.0	82.2	79.4	76.8	74.3	71.7	69.3	66.9	64.5	62.1	59.8	57.5	55.3	53.1
7	103	0.0091	0.8197	0.1442	0.0000	93.7	90.5	87.7	85.1	82.6	80.1	77.8	75.5	73.2	71.0	68.8	66.6	64.5	62.4	60.3	58.2	56.2
8	112	0.0092	0.7994	0.1088	0.0000	92.7	89.9	87.4	85.1	82.8	80.5	78.4	76.3	74.2	72.1	70.1	68.1	66.1	64.2	62.3	60.3	58.5
9	121	0.0093	0.7801	0.0821	0.0000	91.9	89.5	87.2	85.0	82.9	80.9	78.9	77.0	75.0	73.1	71.3	69.4	67.6	65.8	64.0	62.2	60.4
10	130	0.0092	0.7619	0.0619	0.0000	91.3	89.1	87.0	85.0	83.1	81.2	79.4	77.6	75.8	74.0	72.3	70.5	68.8	67.1	65.5	63.8	62.1
11	138	0.0099	0.7358	0.0445	0.0000	90.7	88.7	86.8	85.0	83.2	81.4	79.7	77.9	76.3	74.6	73.0	71.3	69.7	68.1	66.5	65.0	63.4
12	147	0.0096	0.7194	0.0335	0.0000	90.3	88.5	86.7	85.0	83.3	81.7	80.0	78.4	76.9	75.3	73.7	72.2	70.7	69.2	67.7	66.2	64.8
13	156	0.0094	0.7038	0.0252	0.0000	90.0	88.3	86.6	85.0	83.4	81.9	80.4	78.9	77.4	75.9	74.5	73.0	71.6	70.2	68.8	67.4	66.0
14	164	0.0098	0.6800	0.0181	0.0000	89.6	88.0	86.5	85.0	83.5	82.0	80.6	79.1	77.7	76.3	75.0	73.6	72.2	70.9	69.5	68.2	66.9
15	173	0.0094	0.6659	0.0136	0.0000	89.4	87.9	86.4	85.0	83.6	82.2	80.9	79.5	78.2	76.8	75.5	74.2	72.9	71.7	70.4	69.1	67.9
16	181	0.0097	0.6435	0.0097	0.0000	89.1	87.7	86.3	85.0	83.6	82.3	81.0	79.7	78.5	77.2	75.9	74.7	73.5	72.2	71.0	69.8	68.6
17	190	0.0093	0.6308	0.0073	0.0000	88.9	87.6	86.3	85.0	83.8	82.5	81.3	80.0	78.8	77.6	76.4	75.3	74.1	72.9	71.7	70.6	69.4
18	198	0.0096	0.6098	0.0052	0.0000	88.7	87.5	86.2	85.0	83.8	82.6	81.4	80.2	79.1	77.9	76.8	75.6	74.5	73.4	72.3	71.2	70.1
19	206	0.0098	0.5894	0.0037	0.0000	88.5	87.3	86.1	85.0	83.8	82.7	81.5	80.4	79.3	78.2	77.1	76.0	74.9	73.8	72.8	71.7	70.6
20	214	0.0099	0.5697	0.0027	0.0000	88.4	87.2	86.1	85.0	83.8	82.7	81.7	80.6	79.5	78.4	77.4	76.3	75.3	74.3	73.2	72.2	71.2
21	223	0.0094	0.5594	0.0020	0.0000	88.3	87.2	86.1	85.0	83.9	82.9	81.8	80.8	79.8	78.8	77.8	76.7	75.7	74.8	73.8	72.8	71.8
22	231	0.0095	0.5408	0.0014	0.0000	88.1	87.1	86.0	85.0	84.0	83.0	81.9	81.0	80.0	79.0	78.0	77.0	76.1	75.1	74.2	73.2	72.3
23	239	0.0096	0.5229	0.0010	0.0000	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.1	80.1	79.2	78.2	77.3	76.4	75.4	74.5	73.6	72.7
24	247	0.0097	0.5056	0.0007	0.0000	87.9	86.9	85.9	85.0	84.0	83.1	82.1	81.2	80.3	79.4	78.5	77.6	76.7	75.8	74.9	74.0	73.1
25	255	0.0098	0.4888	0.0005	0.0000	87.8	86.8	85.9	85.0	84.0	83.1	82.2	81.3	80.4	79.6	78.7	77.8	76.9	76.1	75.2	74.3	73.5
26	263	0.0098	0.4727	0.0004	0.0000	87.7	86.8	85.9	85.0	84.1	83.2	82.3	81.4	80.6	79.7	78.9	78.0	77.2	76.3	75.5	74.7	73.8
27	271	0.0098	0.4571	0.0003	0.0000	87.6	86.7	85.8	85.0	84.1	83.2	82.4	81.6	80.7	79.9	79.1	78.2	77.4	76.6	75.8	75.0	74.2
28	279	0.0098	0.4420	0.0002	0.0000	87.5	86.6	85.8	85.0	84.1	83.3	82.5	81.7	80.8	80.0	79.2	78.4	77.6	76.8	76.1	75.3	74.5
29	287	0.0098	0.4274	0.0001	0.0000	87.4	86.6	85.8	85.0	84.2	83.3	82.6	81.8	81.0	80.2	79.4	78.6	77.9	77.1	76.3	75.5	74.8
30	295	0.0098	0.4134	0.0001	0.0000	87.3	86.5	85.8	85.0	84.2	83.4	82.6	81.9	81.1	80.3	79.6	78.8	78.1	77.3	76.6	75.8	75.1
31	303	0.0098	0.3998	0.0001	0.0000	87.3	86.5	85.7	85.0	84.2	83.4	82.7	81.9	81.2	80.5	79.7	79.0	78.2	77.5	76.8	76.1	75.3
32	311	0.0097	0.3867	0.0000	0.0000	87.2	86.5	85.7	85.0	84.2	83.5	82.8	82.0	81.3	80.6	79.9	79.1	78.4	77.7	77.0	76.3	75.6
33	319	0.0097	0.3740	0.0000	0.0000	87.2	86.4	85.7	85.0	84.2	83.5	82.8	82.1	81.4	80.7	80.0	79.3	78.6	77.9	77.2	76.5	75.9
34	327	0.0096	0.3618	0.0000	0.0000	87.1	86.4	85.7	85.0	84.3	83.6	82.9	82.2	81.5	80.8	80.1	79.5	78.8	78.1	77.4	76.8	76.1
35	335	0.0096	0.3501	0.0000	0.0000	87.1	86.4	85.7	85.0	84.3	83.6	82.9	82.3	81.6	80.9	80.3	79.6	78.9	78.3	77.6	77.0	76.3

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A5. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 85.0% WITH A CONSUMER RISK OF 0.05

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	19	0.0456	0.8649	0.6226	0.1738	****	****	****	85.4	70.4	58.0	47.0	36.8	27.3	18.7	10.9	4.4	0.2	****	****	****	****
1	30	0.0480	0.8163	0.4465	0.0361	****	****	****	85.1	76.1	68.1	60.6	53.4	46.6	40.1	33.8	27.8	22.1	16.6	11.5	6.8	2.7
2	40	0.0486	0.7772	0.3233	0.0075	****	****	92.7	85.0	78.5	72.5	66.8	61.2	55.9	50.8	45.7	40.8	36.1	31.4	26.9	22.5	18.3
3	50	0.0460	0.7497	0.2396	0.0016	****	****	90.8	85.2	80.1	75.3	70.6	66.2	61.8	57.6	53.4	49.3	45.4	41.4	37.6	33.8	30.1
4	59	0.0469	0.7152	0.1719	0.0003	****	95.0	89.7	85.1	80.9	76.8	72.9	69.1	65.4	61.7	58.1	54.6	51.2	47.7	44.4	41.1	37.8
5	68	0.0465	0.6859	0.1242	0.0001	****	93.2	88.9	85.1	81.5	78.0	74.6	71.3	68.0	64.8	61.7	58.6	55.6	52.5	49.6	46.6	43.7
6	76	0.0497	0.6467	0.0856	0.0000	96.1	91.9	88.3	85.0	81.8	78.7	75.6	72.7	69.8	66.9	64.1	61.3	58.5	55.8	53.1	50.4	47.8
7	85	0.0478	0.6247	0.0624	0.0000	94.5	91.1	88.0	85.0	82.2	79.4	76.7	74.1	71.5	68.9	66.4	63.8	61.4	58.9	56.5	54.0	51.7
8	93	0.0496	0.5919	0.0432	0.0000	93.3	90.4	87.6	85.0	82.4	79.9	77.4	75.0	72.6	70.3	67.9	65.6	63.3	61.1	58.8	56.6	54.4
9	102	0.0471	0.5746	0.0318	0.0000	92.5	89.9	87.4	85.1	82.7	80.5	78.2	76.0	73.8	71.7	69.5	67.4	65.3	63.3	61.2	59.2	57.1
10	110	0.0481	0.5464	0.0221	0.0000	91.8	89.5	87.2	85.0	82.9	80.8	78.7	76.7	74.6	72.6	70.7	68.7	66.8	64.8	62.9	61.0	59.1
11	118	0.0488	0.5203	0.0153	0.0000	91.2	89.1	87.0	85.0	83.0	81.1	79.1	77.2	75.3	73.5	71.6	69.8	68.0	66.2	64.4	62.6	60.8
12	126	0.0492	0.4959	0.0107	0.0000	90.8	88.8	86.9	85.0	83.1	81.3	79.5	77.7	76.0	74.2	72.5	70.8	69.1	67.4	65.7	64.0	62.4
13	134	0.0494	0.4731	0.0074	0.0000	90.4	88.5	86.7	85.0	83.2	81.5	79.8	78.2	76.5	74.9	73.3	71.6	70.0	68.4	66.9	65.3	63.7
14	142	0.0494	0.4518	0.0052	0.0000	90.0	88.3	86.6	85.0	83.3	81.7	80.1	78.6	77.0	75.5	73.9	72.4	70.9	69.4	67.9	66.4	64.9
15	150	0.0493	0.4318	0.0036	0.0000	89.7	88.1	86.5	85.0	83.4	81.9	80.4	78.9	77.5	76.0	74.5	73.1	71.7	70.2	68.8	67.4	66.0
16	158	0.0491	0.4130	0.0025	0.0000	89.5	87.9	86.4	85.0	83.5	82.1	80.7	79.3	77.9	76.5	75.1	73.7	72.4	71.0	69.6	68.3	67.0
17	166	0.0488	0.3954	0.0018	0.0000	89.2	87.8	86.4	85.0	83.6	82.2	80.9	79.6	78.2	76.9	75.6	74.3	73.0	71.7	70.4	69.1	67.9
18	174	0.0483	0.3787	0.0012	0.0000	89.0	87.7	86.3	85.0	83.7	82.4	81.1	79.8	78.6	77.3	76.0	74.8	73.6	72.3	71.1	69.9	68.7
19	182	0.0478	0.3630	0.0009	0.0000	88.8	87.5	86.3	85.0	83.8	82.5	81.3	80.1	78.9	77.7	76.5	75.3	74.1	72.9	71.7	70.6	69.4
20	190	0.0473	0.3481	0.0006	0.0000	88.7	87.4	86.2	85.0	83.8	82.6	81.5	80.3	79.2	78.0	76.9	75.7	74.6	73.4	72.3	71.2	70.1
21	197	0.0495	0.3252	0.0004	0.0000	88.5	87.3	86.1	85.0	83.8	82.7	81.5	80.4	79.3	78.2	77.1	76.0	74.9	73.8	72.7	71.6	70.6
22	205	0.0488	0.3122	0.0003	0.0000	88.3	87.2	86.1	85.0	83.9	82.8	81.7	80.6	79.6	78.5	77.4	76.4	75.3	74.3	73.2	72.2	71.2
23	213	0.0480	0.2998	0.0002	0.0000	88.2	87.1	86.1	85.0	83.9	82.9	81.9	80.8	79.8	78.8	77.7	76.7	75.7	74.7	73.7	72.7	71.7
24	220	0.0499	0.2802	0.0001	0.0000	88.1	87.0	86.0	85.0	83.9	82.9	81.9	80.9	79.9	78.9	77.9	77.0	76.0	75.0	74.0	73.1	72.1
25	228	0.0490	0.2693	0.0001	0.0000	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.1	80.1	79.2	78.2	77.3	76.3	75.4	74.4	73.5	72.6
26	236	0.0482	0.2589	0.0001	0.0000	87.9	86.9	85.9	85.0	84.0	83.1	82.2	81.2	80.3	79.4	78.5	77.6	76.6	75.7	74.8	73.9	73.0
27	243	0.0498	0.2421	0.0000	0.0000	87.7	86.8	85.9	85.0	84.0	83.1	82.2	81.3	80.4	79.5	78.6	77.7	76.8	76.0	75.1	74.2	73.3
28	251	0.0488	0.2329	0.0000	0.0000	87.7	86.8	85.9	85.0	84.1	83.2	82.3	81.5	80.6	79.7	78.9	78.0	77.1	76.3	75.4	74.6	73.7
29	259	0.0479	0.2242	0.0000	0.0000	87.6	86.7	85.9	85.0	84.1	83.3	82.4	81.6	80.7	79.9	79.1	78.2	77.4	76.6	75.8	74.9	74.1
30	266	0.0493	0.2097	0.0000	0.0000	87.5	86.6	85.8	85.0	84.1	83.3	82.5	81.7	80.8	80.0	79.2	78.4	77.6	76.8	76.0	75.2	74.4
31	274	0.0483	0.2020	0.0000	0.0000	87.4	86.6	85.8	85.0	84.2	83.4	82.6	81.8	81.0	80.2	79.4	78.6	77.8	77.0	76.3	75.5	74.7
32	281	0.0497	0.1890	0.0000	0.0000	87.3	86.5	85.7	85.0	84.2	83.4	82.6	81.8	81.1	80.3	79.5	78.7	78.0	77.2	76.5	75.7	74.9
33	289	0.0486	0.1821	0.0000	0.0000	87.3	86.5	85.7	85.0	84.2	83.5	82.7	81.9	81.2	80.4	79.7	78.9	78.2	77.5	76.7	76.0	75.2
34	296	0.0499	0.1704	0.0000	0.0000	87.2	86.5	85.7	85.0	84.2	83.5	82.7	82.0	81.3	80.5	79.8	79.1	78.3	77.6	76.9	76.2	75.5
35	304	0.0487	0.1643	0.0000	0.0000	87.2	86.4	85.7	85.0	84.3	83.5	82.8	82.1	81.4	80.7	80.0	79.2	78.5	77.8	77.1	76.4	75.7

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A6. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 85.0% WITH A CONSUMER RISK OF 0.10

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	90.0%	95.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	15	0.0874	0.7941	0.5367	0.1399	****	****	****	85.7	68.2	53.6	40.3	28.2	17.1	7.5	0.7	****	****	****	****	****	****
1	25	0.0931	0.7288	0.3576	0.0258	****	****	****	85.3	75.2	66.0	57.4	49.2	41.3	33.7	26.5	19.6	13.1	7.1	2.1	0.0	****
2	34	0.0975	0.6745	0.2407	0.0047	****	****	93.4	85.0	77.8	71.0	64.6	58.3	52.2	46.3	40.6	35.0	29.5	24.2	19.1	14.2	9.5
3	43	0.0964	0.6352	0.1666	0.0009	****	****	91.2	85.1	79.4	74.1	68.9	63.9	59.0	54.2	49.5	44.9	40.3	35.9	31.5	27.2	23.0
4	52	0.0931	0.6046	0.1174	0.0002	****	95.6	90.0	85.2	80.6	76.2	71.9	67.7	63.6	59.6	55.6	51.7	47.8	44.0	40.2	36.5	32.9
5	60	0.0968	0.5628	0.0787	0.0000	****	93.6	89.2	85.0	81.1	77.3	73.6	70.0	66.4	62.8	59.4	55.9	52.5	49.2	45.9	42.6	39.3
6	68	0.0990	0.5266	0.0531	0.0000	96.6	92.3	88.5	85.0	81.5	78.2	74.9	71.7	68.5	65.4	62.3	59.3	56.2	53.2	50.3	47.3	44.4
7	77	0.0925	0.5098	0.0385	0.0000	95.0	91.5	88.2	85.1	82.1	79.2	76.3	73.5	70.6	67.9	65.1	62.4	59.7	57.0	54.4	51.8	49.1
8	85	0.0932	0.4805	0.0262	0.0000	93.8	90.8	87.9	85.1	82.4	79.8	77.1	74.6	72.0	69.5	67.0	64.5	62.1	59.6	57.2	54.8	52.4
9	93	0.0932	0.4541	0.0179	0.0000	92.9	90.2	87.6	85.1	82.6	80.2	77.8	75.5	73.2	70.9	68.6	66.3	64.0	61.8	59.6	57.4	55.2
10	100	0.0994	0.4168	0.0115	0.0000	92.1	89.7	87.3	85.0	82.7	80.4	78.2	76.0	73.9	71.7	69.6	67.5	65.4	63.3	61.2	59.2	57.1
11	108	0.0984	0.3955	0.0079	0.0000	91.5	89.3	87.1	85.0	82.9	80.8	78.8	76.7	74.7	72.8	70.8	68.8	66.9	64.9	63.0	61.1	59.2
12	116	0.0972	0.3758	0.0054	0.0000	91.0	89.0	87.0	85.0	83.1	81.1	79.2	77.4	75.5	73.6	71.8	70.0	68.2	66.3	64.6	62.8	61.0
13	124	0.0958	0.3577	0.0037	0.0000	90.6	88.7	86.9	85.0	83.2	81.4	79.7	77.9	76.1	74.4	72.7	71.0	69.3	67.6	65.9	64.2	62.6
14	132	0.0942	0.3409	0.0026	0.0000	90.3	88.5	86.8	85.1	83.4	81.7	80.0	78.4	76.7	75.1	73.5	71.9	70.3	68.7	67.1	65.5	63.9
15	139	0.0982	0.3149	0.0017	0.0000	89.9	88.3	86.6	85.0	83.4	81.8	80.2	78.6	77.1	75.5	74.0	72.5	71.0	69.4	67.9	66.4	64.9
16	147	0.0963	0.3007	0.0012	0.0000	89.7	88.1	86.5	85.0	83.5	82.0	80.5	79.0	77.6	76.1	74.6	73.2	71.8	70.3	68.9	67.5	66.1
17	154	0.0998	0.2781	0.0007	0.0000	89.4	87.9	86.4	85.0	83.5	82.1	80.7	79.3	77.9	76.5	75.1	73.7	72.3	70.9	69.6	68.2	66.9
18	162	0.0975	0.2661	0.0005	0.0000	89.2	87.8	86.4	85.0	83.6	82.3	80.9	79.6	78.2	76.9	75.6	74.3	73.0	71.7	70.4	69.1	67.8
19	170	0.0953	0.2548	0.0004	0.0000	89.0	87.7	86.3	85.0	83.7	82.4	81.2	79.9	78.6	77.3	76.1	74.8	73.6	72.4	71.1	69.9	68.7
20	177	0.0982	0.2362	0.0002	0.0000	88.8	87.5	86.2	85.0	83.7	82.5	81.3	80.0	78.8	77.6	76.4	75.2	74.0	72.8	71.6	70.4	69.3
21	185	0.0958	0.2265	0.0002	0.0000	88.6	87.4	86.2	85.0	83.8	82.6	81.5	80.3	79.1	78.0	76.8	75.7	74.5	73.4	72.2	71.1	70.0
22	192	0.0984	0.2101	0.0001	0.0000	88.5	87.3	86.1	85.0	83.8	82.7	81.6	80.4	79.3	78.2	77.1	76.0	74.9	73.8	72.7	71.6	70.5
23	200	0.0959	0.2017	0.0001	0.0000	88.3	87.2	86.1	85.0	83.9	82.8	81.7	80.7	79.6	78.5	77.4	76.4	75.3	74.3	73.2	72.2	71.1
24	207	0.0982	0.1872	0.0000	0.0000	88.2	87.1	86.0	85.0	83.9	82.9	81.8	80.8	79.7	78.7	77.7	76.7	75.6	74.6	73.6	72.6	71.6
25	215	0.0957	0.1800	0.0000	0.0000	88.1	87.1	86.0	85.0	84.0	83.0	82.0	81.0	80.0	79.0	78.0	77.0	76.0	75.0	74.1	73.1	72.1
26	222	0.0978	0.1672	0.0000	0.0000	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.1	80.1	79.1	78.2	77.2	76.3	75.3	74.4	73.4	72.5
27	229	0.0997	0.1553	0.0000	0.0000	87.8	86.9	85.9	85.0	84.0	83.1	82.1	81.2	80.2	79.3	78.4	77.4	76.5	75.6	74.7	73.8	72.8
28	237	0.0971	0.1495	0.0000	0.0000	87.8	86.8	85.9	85.0	84.1	83.2	82.2	81.3	80.4	79.5	78.6	77.7	76.8	76.0	75.1	74.2	73.3
29	244	0.0989	0.1390	0.0000	0.0000	87.7	86.8	85.9	85.0	84.1	83.2	82.3	81.4	80.5	79.7	78.8	77.9	77.1	76.2	75.3	74.5	73.6
30	252	0.0962	0.1339	0.0000	0.0000	87.6	86.7	85.9	85.0	84.1	83.3	82.4	81.6	80.7	79.9	79.0	78.2	77.4	76.5	75.7	74.8	74.0
31	259	0.0978	0.1246	0.0000	0.0000	87.5	86.7	85.8	85.0	84.1	83.3	82.5	81.6	80.8	80.0	79.2	78.4	77.5	76.7	75.9	75.1	74.3
32	266	0.0994	0.1159	0.0000	0.0000	87.4	86.6	85.8	85.0	84.1	83.3	82.5	81.7	80.9	80.1	79.3	78.5	77.7	76.9	76.1	75.3	74.6
33	274	0.0967	0.1118	0.0000	0.0000	87.4	86.6	85.8	85.0	84.2	83.4	82.6	81.9	81.1	80.3	79.5	78.7	78.0	77.2	76.4	75.7	74.9
34	281	0.0981	0.1040	0.0000	0.0000	87.3	86.5	85.7	85.0	84.2	83.4	82.7	81.9	81.2	80.4	79.6	78.9	78.1	77.4	76.6	75.9	75.1
35	288	0.0995	0.0968	0.0000	0.0000	87.2	86.5	85.7	85.0	84.2	83.5	82.7	82.0	81.2	80.5	79.8	79.0	78.3	77.6	76.8	76.1	75.4

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A7. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 90.0% WITH A CONSUMER RISK OF 0.01

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	95.0%	97.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	44	0.0097	0.8953	0.7382	0.3574	****	****	****	90.0	82.2	75.8	69.9	64.5	59.3	54.4	49.6	45.0	40.5	36.2	32.0	27.9	24.0
1	64	0.0096	0.8361	0.5759	0.1346	****	****	****	90.0	85.1	80.7	76.7	72.8	69.1	65.5	62.0	58.6	55.2	51.9	48.7	45.6	42.5
2	81	0.0098	0.7766	0.4398	0.0480	****	****	94.4	90.0	86.3	82.9	79.7	76.6	73.6	70.7	67.9	65.1	62.4	59.7	57.1	54.5	51.9
3	97	0.0099	0.7203	0.3323	0.0166	****	****	93.3	90.0	87.0	84.2	81.5	79.0	76.5	74.0	71.6	69.3	67.0	64.7	62.5	60.2	58.0
4	113	0.0094	0.6717	0.2522	0.0058	****	96.0	92.7	90.0	87.5	85.2	82.9	80.7	78.6	76.5	74.4	72.4	70.3	68.4	66.4	64.5	62.6
5	128	0.0093	0.6216	0.1877	0.0019	****	94.9	92.3	90.0	87.9	85.8	83.8	81.9	80.0	78.1	76.3	74.5	72.7	71.0	69.2	67.5	65.8
6	142	0.0096	0.5692	0.1364	0.0006	96.8	94.2	92.0	90.0	88.1	86.3	84.5	82.7	81.0	79.4	77.7	76.1	74.5	72.9	71.3	69.7	68.2
7	156	0.0096	0.5217	0.0989	0.0002	95.8	93.7	91.8	90.0	88.3	86.6	85.0	83.4	81.9	80.4	78.9	77.4	75.9	74.5	73.0	71.6	70.2
8	170	0.0095	0.4787	0.0718	0.0001	95.1	93.3	91.6	90.0	88.4	86.9	85.5	84.0	82.6	81.2	79.8	78.5	77.1	75.8	74.5	73.1	71.8
9	183	0.0099	0.4328	0.0505	0.0000	94.6	92.9	91.4	90.0	88.5	87.2	85.8	84.5	83.2	81.9	80.6	79.3	78.1	76.8	75.6	74.4	73.1
10	197	0.0096	0.3977	0.0366	0.0000	94.2	92.7	91.3	90.0	88.7	87.4	86.2	84.9	83.7	82.5	81.3	80.1	79.0	77.8	76.7	75.5	74.4
11	210	0.0097	0.3597	0.0257	0.0000	93.8	92.5	91.2	90.0	88.8	87.6	86.4	85.2	84.1	83.0	81.9	80.8	79.7	78.6	77.5	76.4	75.4
12	223	0.0098	0.3254	0.0180	0.0000	93.5	92.3	91.1	90.0	88.8	87.7	86.6	85.5	84.5	83.4	82.4	81.3	80.3	79.3	78.3	77.2	76.2
13	236	0.0098	0.2943	0.0127	0.0000	93.3	92.2	91.0	90.0	88.9	87.9	86.8	85.8	84.8	83.8	82.8	81.8	80.9	79.9	78.9	78.0	77.0
14	249	0.0098	0.2662	0.0089	0.0000	93.1	92.0	91.0	90.0	89.0	88.0	87.0	86.0	85.1	84.1	83.2	82.3	81.4	80.4	79.5	78.6	77.7
15	262	0.0097	0.2409	0.0062	0.0000	92.9	91.9	90.9	90.0	89.0	88.1	87.2	86.3	85.4	84.5	83.6	82.7	81.8	80.9	80.1	79.2	78.4
16	275	0.0096	0.2180	0.0043	0.0000	92.8	91.8	90.9	90.0	89.1	88.2	87.3	86.5	85.6	84.7	83.9	83.1	82.2	81.4	80.6	79.8	78.9
17	287	0.0099	0.1934	0.0029	0.0000	92.6	91.7	90.8	90.0	89.1	88.3	87.4	86.6	85.8	85.0	84.2	83.3	82.6	81.8	81.0	80.2	79.4
18	300	0.0097	0.1750	0.0021	0.0000	92.5	91.6	90.8	90.0	89.2	88.3	87.6	86.8	86.0	85.2	84.4	83.7	82.9	82.1	81.4	80.6	79.9
19	312	0.0099	0.1552	0.0014	0.0000	92.3	91.5	90.7	90.0	89.2	88.4	87.6	86.9	86.1	85.4	84.6	83.9	83.2	82.4	81.7	81.0	80.3
20	325	0.0097	0.1405	0.0010	0.0000	92.3	91.5	90.7	90.0	89.2	88.5	87.8	87.0	86.3	85.6	84.9	84.2	83.5	82.8	82.1	81.4	80.7
21	337	0.0099	0.1245	0.0006	0.0000	92.1	91.4	90.7	90.0	89.2	88.5	87.8	87.1	86.4	85.8	85.1	84.4	83.7	83.0	82.4	81.7	81.0
22	350	0.0096	0.1128	0.0005	0.0000	92.1	91.4	90.7	90.0	89.3	88.6	87.9	87.3	86.6	85.9	85.3	84.6	84.0	83.3	82.7	82.0	81.4
23	362	0.0097	0.0999	0.0003	0.0000	92.0	91.3	90.6	90.0	89.3	88.6	88.0	87.4	86.7	86.1	85.4	84.8	84.2	83.5	82.9	82.3	81.7
24	374	0.0098	0.0885	0.0002	0.0000	91.9	91.3	90.6	90.0	89.3	88.7	88.1	87.4	86.8	86.2	85.6	85.0	84.4	83.8	83.2	82.6	82.0
25	386	0.0099	0.0783	0.0001	0.0000	91.8	91.2	90.6	90.0	89.3	88.7	88.1	87.5	86.9	86.3	85.7	85.1	84.5	84.0	83.4	82.8	82.2
26	399	0.0096	0.0710	0.0001	0.0000	91.8	91.2	90.6	90.0	89.4	88.8	88.2	87.6	87.0	86.5	85.9	85.3	84.7	84.2	83.6	83.1	82.5
27	411	0.0096	0.0628	0.0001	0.0000	91.7	91.1	90.6	90.0	89.4	88.8	88.3	87.7	87.1	86.6	86.0	85.5	84.9	84.4	83.8	83.3	82.7
28	423	0.0096	0.0556	0.0000	0.0000	91.7	91.1	90.5	90.0	89.4	88.9	88.3	87.8	87.2	86.7	86.1	85.6	85.1	84.5	84.0	83.5	82.9
29	435	0.0097	0.0492	0.0000	0.0000	91.6	91.1	90.5	90.0	89.4	88.9	88.4	87.8	87.3	86.8	86.2	85.7	85.2	84.7	84.2	83.6	83.1
30	447	0.0097	0.0436	0.0000	0.0000	91.6	91.0	90.5	90.0	89.4	88.9	88.4	87.9	87.4	86.9	86.3	85.8	85.3	84.8	84.3	83.8	83.3
31	459	0.0097	0.0385	0.0000	0.0000	91.5	91.0	90.5	90.0	89.5	88.9	88.4	87.9	87.4	86.9	86.4	86.0	85.5	85.0	84.5	84.0	83.5
32	471	0.0096	0.0341	0.0000	0.0000	91.5	91.0	90.5	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.1	85.6	85.1	84.6	84.2	83.7
33	483	0.0096	0.0302	0.0000	0.0000	91.4	90.9	90.5	90.0	89.5	89.0	88.5	88.1	87.6	87.1	86.6	86.2	85.7	85.2	84.8	84.3	83.8
34	494	0.0099	0.0260	0.0000	0.0000	91.4	90.9	90.4	90.0	89.5	89.0	88.5	88.1	87.6	87.2	86.7	86.2	85.8	85.3	84.9	84.4	84.0
35	506	0.0099	0.0230	0.0000	0.0000	91.3	90.9	90.4	90.0	89.5	89.0	88.6	88.1	87.7	87.2	86.8	86.3	85.9	85.4	85.0	84.6	84.1

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A8. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 90.0% WITH A CONSUMER RISK OF 0.05

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X															
X	N	CRISK	95.0%	97.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	29	0.0471	0.7741	0.5866	0.2528	****	****	****	90.1	79.8	71.1	63.2	55.7	48.5	41.7	35.2	28.9	22.9	17.2	11.9	7.0	2.8
1	46	0.0480	0.6768	0.4032	0.0775	****	****	****	90.0	84.0	78.4	73.3	68.3	63.5	58.8	54.3	49.8	45.5	41.2	37.0	32.9	29.0
2	61	0.0491	0.5939	0.2767	0.0234	****	****	95.2	90.0	85.6	81.5	77.5	73.7	70.0	66.4	62.9	59.4	56.0	52.6	49.3	46.0	42.8
3	76	0.0470	0.5307	0.1943	0.0072	****	****	93.9	90.1	86.6	83.3	80.2	77.1	74.1	71.2	68.3	65.5	62.7	59.9	57.1	54.4	51.7
4	89	0.0497	0.4606	0.1297	0.0021	****	96.6	93.0	90.0	87.1	84.3	81.6	79.0	76.5	73.9	71.5	69.0	66.6	64.2	61.8	59.4	57.1
5	103	0.0479	0.4110	0.0901	0.0006	****	95.4	92.6	90.0	87.6	85.2	82.9	80.6	78.4	76.2	74.1	71.9	69.8	67.7	65.7	63.6	61.6
6	116	0.0484	0.3607	0.0608	0.0002	97.4	94.6	92.2	90.0	87.9	85.8	83.7	81.7	79.8	77.8	75.9	74.0	72.1	70.2	68.4	66.5	64.7
7	129	0.0482	0.3178	0.0412	0.0001	96.3	94.1	92.0	90.0	88.1	86.2	84.4	82.6	80.8	79.1	77.4	75.6	73.9	72.3	70.6	68.9	67.3
8	142	0.0476	0.2809	0.0280	0.0000	95.6	93.6	91.8	90.0	88.3	86.6	85.0	83.3	81.7	80.1	78.6	77.0	75.5	73.9	72.4	70.9	69.4
9	154	0.0491	0.2429	0.0183	0.0000	95.0	93.2	91.6	90.0	88.4	86.9	85.3	83.9	82.4	80.9	79.5	78.0	76.6	75.2	73.8	72.4	71.0
10	167	0.0477	0.2157	0.0125	0.0000	94.6	93.0	91.5	90.0	88.6	87.2	85.8	84.4	83.0	81.7	80.3	79.0	77.7	76.4	75.1	73.8	72.5
11	179	0.0486	0.1871	0.0082	0.0000	94.2	92.7	91.3	90.0	88.7	87.3	86.0	84.8	83.5	82.2	81.0	79.8	78.5	77.3	76.1	74.9	73.7
12	191	0.0491	0.1624	0.0054	0.0000	93.8	92.5	91.2	90.0	88.7	87.5	86.3	85.1	83.9	82.7	81.6	80.4	79.3	78.1	77.0	75.8	74.7
13	203	0.0495	0.1411	0.0035	0.0000	93.6	92.3	91.1	90.0	88.8	87.7	86.5	85.4	84.3	83.2	82.1	81.0	79.9	78.8	77.8	76.7	75.6
14	215	0.0496	0.1227	0.0023	0.0000	93.3	92.2	91.1	90.0	88.9	87.8	86.7	85.7	84.6	83.6	82.5	81.5	80.5	79.5	78.4	77.4	76.4
15	227	0.0496	0.1068	0.0015	0.0000	93.1	92.1	91.0	90.0	88.9	87.9	86.9	85.9	84.9	83.9	82.9	82.0	81.0	80.0	79.1	78.1	77.2
16	239	0.0495	0.0931	0.0010	0.0000	93.0	91.9	90.9	90.0	89.0	88.0	87.1	86.1	85.2	84.2	83.3	82.4	81.5	80.6	79.6	78.7	77.8
17	251	0.0493	0.0811	0.0007	0.0000	92.8	91.8	90.9	90.0	89.0	88.1	87.2	86.3	85.4	84.5	83.6	82.8	81.9	81.0	80.2	79.3	78.4
18	263	0.0490	0.0708	0.0004	0.0000	92.7	91.8	90.9	90.0	89.1	88.2	87.4	86.5	85.6	84.8	84.0	83.1	82.3	81.4	80.6	79.8	79.0
19	275	0.0486	0.0618	0.0003	0.0000	92.5	91.7	90.8	90.0	89.1	88.3	87.5	86.7	85.9	85.0	84.2	83.4	82.6	81.8	81.0	80.3	79.5
20	286	0.0500	0.0524	0.0002	0.0000	92.4	91.6	90.8	90.0	89.1	88.4	87.6	86.8	86.0	85.2	84.4	83.7	82.9	82.1	81.4	80.6	79.9
21	298	0.0494	0.0458	0.0001	0.0000	92.3	91.5	90.7	90.0	89.2	88.4	87.7	86.9	86.2	85.4	84.7	83.9	83.2	82.5	81.7	81.0	80.3
22	310	0.0488	0.0400	0.0001	0.0000	92.2	91.5	90.7	90.0	89.2	88.5	87.8	87.1	86.3	85.6	84.9	84.2	83.5	82.8	82.1	81.4	80.7
23	321	0.0499	0.0339	0.0000	0.0000	92.1	91.4	90.7	90.0	89.2	88.5	87.8	87.1	86.4	85.8	85.1	84.4	83.7	83.0	82.3	81.7	81.0
24	333	0.0492	0.0297	0.0000	0.0000	92.0	91.3	90.7	90.0	89.3	88.6	87.9	87.3	86.6	85.9	85.3	84.6	83.9	83.3	82.6	82.0	81.3
25	345	0.0484	0.0260	0.0000	0.0000	92.0	91.3	90.6	90.0	89.3	88.7	88.0	87.4	86.7	86.1	85.4	84.8	84.2	83.5	82.9	82.3	81.7
26	356	0.0493	0.0221	0.0000	0.0000	91.9	91.2	90.6	90.0	89.3	88.7	88.1	87.4	86.8	86.2	85.6	85.0	84.3	83.7	83.1	82.5	81.9
27	368	0.0485	0.0193	0.0000	0.0000	91.8	91.2	90.6	90.0	89.4	88.8	88.1	87.5	86.9	86.3	85.7	85.1	84.5	84.0	83.4	82.8	82.2
28	379	0.0493	0.0164	0.0000	0.0000	91.8	91.2	90.6	90.0	89.4	88.8	88.2	87.6	87.0	86.4	85.9	85.3	84.7	84.1	83.6	83.0	82.4
29	390	0.0500	0.0139	0.0000	0.0000	91.7	91.1	90.5	90.0	89.4	88.8	88.2	87.7	87.1	86.5	86.0	85.4	84.8	84.3	83.7	83.2	82.6
30	402	0.0491	0.0122	0.0000	0.0000	91.7	91.1	90.5	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.1	85.6	85.0	84.5	83.9	83.4	82.9
31	413	0.0497	0.0104	0.0000	0.0000	91.6	91.0	90.5	90.0	89.4	88.9	88.3	87.8	87.3	86.7	86.2	85.7	85.1	84.6	84.1	83.6	83.0
32	425	0.0488	0.0091	0.0000	0.0000	91.6	91.0	90.5	90.0	89.4	88.9	88.4	87.9	87.4	86.8	86.3	85.8	85.3	84.8	84.3	83.8	83.3
33	436	0.0493	0.0077	0.0000	0.0000	91.5	91.0	90.5	90.0	89.4	88.9	88.4	87.9	87.4	86.9	86.4	85.9	85.4	84.9	84.4	83.9	83.4
34	447	0.0498	0.0066	0.0000	0.0000	91.5	91.0	90.5	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.1	83.6
35	459	0.0488	0.0058	0.0000	0.0000	91.4	90.9	90.5	90.0	89.5	89.0	88.5	88.0	87.6	87.1	86.6	86.1	85.7	85.2	84.7	84.2	83.8

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable

TABLE A9. CRITICAL VALUE TABLE FOR A REQUIRED ACCURACY OF 90.0% WITH A CONSUMER RISK OF 0.10

			Producer Risk Values (Accuracy Levels in %)			Minimum Accuracy Values in Percent for Deviations from X														
X	N	CRISK	95.0%	97.0%	99.0%	−6	−4	−2	0	2	4	6	8	10	12	14	16	18	20	22	24	26
0	22	0.0985	0.6765	0.4883	0.1984	****	****	****	90.0	77.5	66.8	57.0	47.7	38.8	30.4	22.4	15.0	8.1	2.4	0.0	****	****
1	38	0.0953	0.5728	0.3163	0.0555	****	****	****	90.1	83.2	76.9	70.9	65.2	59.6	54.1	48.8	43.6	38.5	33.5	28.6	23.9	19.2
2	52	0.0966	0.4854	0.2046	0.0154	****	****	95.6	90.0	85.2	80.6	76.2	71.9	67.7	63.6	59.6	55.6	51.7	47.8	44.0	40.2	36.5
3	65	0.0996	0.4100	0.1311	0.0042	****	****	94.1	90.0	86.1	82.5	79.0	75.5	72.1	68.8	65.5	62.3	59.1	55.9	52.8	49.7	46.6
4	78	0.0994	0.3511	0.0854	0.0012	****	97.0	93.3	90.0	86.8	83.8	80.9	78.0	75.2	72.4	69.6	66.9	64.2	61.5	58.9	56.2	53.6
5	91	0.0976	0.3036	0.0563	0.0003	****	95.7	92.8	90.0	87.4	84.8	82.3	79.8	77.4	75.0	72.6	70.2	67.9	65.6	63.3	61.0	58.7
6	103	0.1000	0.2567	0.0358	0.0001	97.7	94.9	92.3	90.0	87.6	85.4	83.2	81.0	78.8	76.7	74.6	72.5	70.5	68.4	66.4	64.3	62.3
7	116	0.0964	0.2248	0.0240	0.0000	96.6	94.3	92.1	90.0	88.0	86.0	84.0	82.1	80.2	78.3	76.4	74.6	72.7	70.9	69.1	67.2	65.4
8	128	0.0971	0.1919	0.0154	0.0000	95.8	93.8	91.9	90.0	88.2	86.4	84.6	82.9	81.1	79.4	77.7	76.0	74.3	72.7	71.0	69.4	67.7
9	140	0.0973	0.1642	0.0099	0.0000	95.2	93.4	91.7	90.0	88.3	86.7	85.1	83.5	81.9	80.3	78.8	77.2	75.7	74.2	72.7	71.2	69.6
10	152	0.0969	0.1410	0.0064	0.0000	94.8	93.1	91.5	90.0	88.5	87.0	85.5	84.0	82.6	81.1	79.7	78.3	76.9	75.5	74.1	72.7	71.3
11	164	0.0963	0.1213	0.0042	0.0000	94.4	92.9	91.4	90.0	88.6	87.2	85.8	84.5	83.1	81.8	80.5	79.2	77.9	76.5	75.2	73.9	72.7
12	175	0.0994	0.1012	0.0026	0.0000	94.0	92.6	91.3	90.0	88.7	87.4	86.1	84.8	83.6	82.3	81.1	79.8	78.6	77.4	76.1	74.9	73.7
13	187	0.0981	0.0874	0.0017	0.0000	93.7	92.5	91.2	90.0	88.8	87.6	86.4	85.2	84.0	82.8	81.7	80.5	79.4	78.2	77.1	75.9	74.8
14	199	0.0967	0.0756	0.0011	0.0000	93.5	92.3	91.1	90.0	88.9	87.7	86.6	85.5	84.4	83.3	82.2	81.1	80.0	78.9	77.9	76.8	75.7
15	210	0.0989	0.0633	0.0007	0.0000	93.3	92.2	91.1	90.0	88.9	87.8	86.8	85.7	84.7	83.6	82.6	81.6	80.5	79.5	78.5	77.5	76.5
16	222	0.0971	0.0549	0.0004	0.0000	93.1	92.0	91.0	90.0	89.0	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.1	80.1	79.1	78.2	77.2
17	233	0.0989	0.0461	0.0003	0.0000	92.9	91.9	90.9	90.0	89.0	88.0	87.1	86.1	85.2	84.3	83.3	82.4	81.5	80.6	79.7	78.7	77.8
18	245	0.0969	0.0400	0.0002	0.0000	92.8	91.8	90.9	90.0	89.1	88.2	87.3	86.4	85.5	84.6	83.7	82.8	81.9	81.1	80.2	79.3	78.5
19	256	0.0983	0.0336	0.0001	0.0000	92.6	91.7	90.8	90.0	89.1	88.2	87.4	86.5	85.7	84.8	84.0	83.1	82.3	81.4	80.6	79.8	78.9
20	267	0.0995	0.0283	0.0001	0.0000	92.5	91.6	90.8	90.0	89.1	88.3	87.5	86.6	85.8	85.0	84.2	83.4	82.6	81.8	81.0	80.2	79.4
21	279	0.0973	0.0246	0.0000	0.0000	92.4	91.6	90.8	90.0	89.2	88.4	87.6	86.8	86.0	85.3	84.5	83.7	82.9	82.2	81.4	80.6	79.9
22	290	0.0982	0.0207	0.0000	0.0000	92.3	91.5	90.7	90.0	89.2	88.4	87.7	86.9	86.2	85.4	84.7	83.9	83.2	82.5	81.7	81.0	80.3
23	301	0.0991	0.0175	0.0000	0.0000	92.2	91.4	90.7	90.0	89.2	88.5	87.8	87.0	86.3	85.6	84.9	84.2	83.4	82.7	82.0	81.3	80.6
24	312	0.0999	0.0147	0.0000	0.0000	92.1	91.4	90.7	90.0	89.2	88.5	87.8	87.1	86.4	85.7	85.1	84.4	83.7	83.0	82.3	81.6	80.9
25	324	0.0974	0.0128	0.0000	0.0000	92.0	91.3	90.7	90.0	89.3	88.6	87.9	87.3	86.6	85.9	85.3	84.6	83.9	83.3	82.6	82.0	81.3
26	335	0.0980	0.0108	0.0000	0.0000	92.0	91.3	90.6	90.0	89.3	88.7	88.0	87.4	86.7	86.1	85.4	84.8	84.1	83.5	82.9	82.2	81.6
27	346	0.0986	0.0091	0.0000	0.0000	91.9	91.2	90.6	90.0	89.3	88.7	88.1	87.4	86.8	86.2	85.6	84.9	84.3	83.7	83.1	82.5	81.9
28	357	0.0990	0.0077	0.0000	0.0000	91.8	91.2	90.6	90.0	89.3	88.7	88.1	87.5	86.9	86.3	85.7	85.1	84.5	83.9	83.3	82.7	82.1
29	368	0.0994	0.0065	0.0000	0.0000	91.8	91.2	90.6	90.0	89.4	88.8	88.2	87.6	87.0	86.4	85.8	85.2	84.7	84.1	83.5	82.9	82.3
30	379	0.0997	0.0055	0.0000	0.0000	91.7	91.1	90.5	90.0	89.4	88.8	88.2	87.7	87.1	86.5	85.9	85.4	84.8	84.3	83.7	83.1	82.6
31	390	0.1000	0.0046	0.0000	0.0000	91.6	91.1	90.5	90.0	89.4	88.8	88.3	87.7	87.2	86.6	86.1	85.5	85.0	84.4	83.9	83.3	82.8
32	402	0.0974	0.0041	0.0000	0.0000	91.6	91.1	90.5	90.0	89.4	88.9	88.3	87.8	87.3	86.7	86.2	85.7	85.1	84.6	84.1	83.5	83.0
33	413	0.0976	0.0034	0.0000	0.0000	91.6	91.0	90.5	90.0	89.4	88.9	88.4	87.9	87.3	86.8	86.3	85.8	85.3	84.8	84.2	83.7	83.2
34	424	0.0977	0.0029	0.0000	0.0000	91.5	91.0	90.5	90.0	89.5	88.9	88.4	87.9	87.4	86.9	86.4	85.9	85.4	84.9	84.4	83.9	83.4
35	435	0.0978	0.0025	0.0000	0.0000	91.5	91.0	90.5	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0	83.6

Symbols: X = maximum allowable misclassifications N = required sample size CRISK = exact consumer risk. **** = not applicable