The Influence of Legal Environment upon Accounting in Libya

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1. INTRODUCTION

During the last twenty years accounting in Libya as in many other developing economies had an important function in the Libyan economy. The accounting function as defined by one author includes measurement and communication of economic data.[1] Also the importance of this function was emphasized by one of the former presidents of the American Institute of Certified Public Accountants as follows:

> *One thing that holds the economy together under all the pressures, and in the midst of this swift evolutionary passage through time, is our system of financial reporting . . . without adequate information about the results of business operations no one could make intelligent decisions, and our economy would fall apart.*[2]

Investors, creditors, management, as well as state agencies need much more reliable information in order to make important decisions related to the economic development of Libya. Therefore, the Libyan accounting profession must be developed to fulfill these new demands.

Although accounting development in general have been influenced by the social, economic and legal environment, the modern accounting profession in Libya is relatively new. Until few years ago there was no considerable action to have any professional accounting organization as it is known in other developed countries. Law No. 116 of 1973 was the first complete regulation to be enacted in order to organize the accounting profession in Libya. However, the formation of the organization of Libyan Accountants and Auditors was not completed until 1976. Not much work has been completed by this organization to date.

There are a number of accountants and accounting firms who are licensed by the Organization of Libyan Accountants and Auditors. No systematic body of accepted standards and practices of accounting presently exists in Libya. Also, there are no professional standards of auditing governing the relationships of the practitioner, his clients and the public. As a result, a lack of consistency and uniformity in the preparation and presentation of financial reports is noticeable. Only some Libyan laws and regulations may influence accounting in this respect.

Therefore, the purpose of this article is to examine the influence of the Libyan Laws and regulations upon the practices of accounting in Libya. These laws will include the Commercial Code, the income tax law, the petroleum law and regulations, and Law No. 116 to organize the Libyan accounting profession.

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[1] Herman W. Bevis, "The Accounting Function in Economic Progress, "*The Journal of Accountancy* 106 (August 1958): 28.

[2] Marquis G. Eaton, "Financial Reporting in a Changing Society", *The Journal of Accountancy 104* (August 1957): 25.

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Department of the U.S. Air Force. *Tables of Probabilities for Use in Exploratory Sampling,* Washington, D.C., 1959.

In this type of sampling, the auditor is trying to find just one example of what he is looking for in order to extend his procedures.

In each of these types of sampling, the auditor can determine the sample size needed by the use of published tables. He does not have to be a statistician in order to determine the sample size in a scientific method.

Statistical sampling has several advantages over judgment sampling. It is an objective method and not subject to personal bias. The sample is more representative of the population when it is derived by statistical methods. The sample size can be determined in a scientific manner and does not have to be based on a guess by the auditor. Statistical sampling can also decrease the time that the auditor spends gathering evidential matter, and thus, decrease his client's cost. The use of statistical sampling methods are also impressive to the client since many of them use these methods in controlling their operations.

The accounting profession must realize the possible uses it can make of statistical sampling. The auditor of the future must be adequately trained in statistical methods if he is to perform his duty adequately and economically.

In conclusion, I believe that the increased use of the computer will cause the accountant to turn to statistical methods to test the data adequately. Much of the data will be in a nonvisible form which will make it extremely hard for the auditor to gather the evidential matter based on a pure judgment decision. The computer's ability to turn out voluminious data and the increasing size of today's business will also make it almost impossible to the auditor to gather a representative sample by the traditional method. The auditor is going to be required to be more objective in the way he gathers evidential matter to form his opinion as to the fairness of the financial statements.

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"Relationship of Statistical Sampling to Gene-

Table 3 (continued)

Sample				Total Errors in Universe Size of 6,000.					
30	40	50	75	100	200	300	500	1,000	2,000
99.6	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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since it is taken in an objective manner. It guarantees that personal bias will not affect the sampling process. Random sampling also helps to deter fraud by providing a surprise element in the audit.

Random sampling can be performed in several different ways. Unrestricted random sampling allows each item in the population an equal chance of being included in the sample. Systematic sampling includes every *nth* item in the sample after the first item has been randomly selected. Stratified sampling is effective when the value of items in the population differ extremely. The items are separated into strata and then a random sample is taken of each stratum. Cluster sampling requires that clusters or groups of data are chosen on a random basis.

Random sampling methods can be used in gathering evidential matter even though other statistical methods are not followed. Random sampling must be used, though, for the other statistical methods to be effective when they are used. I feel it would be wise for the auditor to use random sampling methods for each audit since this will make his audit more objective and will also make the sample more representative of the population.

In using statistical methods, other than simply random sampling, the auditor must determine the range in which the true value of the population will lie. This is the precision limit. The auditor must also decide the amount of reliance he is willing to place on the sample. This is known as the confidence level. This is a decision the auditor must make in each audit. He must evaluate the system of internal control, consider past experience in auditing the company, and consider any other knowledge he has about the firm in deciding what the precision and confidence level will be. These cannot be set standards for every audit; they must be influenced by the individual circumstances of each situation.

The precision and confidence level will be a major influence in determining the size of the sample. The sample size can be determined by the use of a definite sampling plan. In determining which sampling plan to use, the auditor must determine exactly what his objective in performing the test. If the auditor's main objective is to determine the frequency of errors or the dollar value of a particular balance sheet item, he can use estimation sampling. The auditor can use acceptance sampling if his purpose is to determine that no more than a certain number of errors exist in the opoulation. If more than this number exist, he rejects the sample and must extend the auditing procedures. Discovery sampling can be used by the auditor when he is looking for fraud.

Table 3 (continued)

Sample Size	Total Errors in Universe Size of 6,000.								
	1	2	3	4	5	10	15	20	25
1,000.0	16.7	30.6	42.1	51.8	59.8	83.9	93.5	97.4	99.0
1,100.0	18.3	33.3	45.5	55.5	63.7	86.8	95.2	98.3	99.4
1,200.0	20.0	36.0	48.8	59.1	67.2	89.3	96.5	98.9	99.6
1,300.0	21.7	38.6	51.9	62.4	70.5	91.3	97.4	99.2	99.8
1,400.0	23.3	41.2	54.9	65.5	73.5	93.0	98.2	99.5	99.9
1,500.0	25.0	43.8	57.8	68.4	76.3	94.4	98.7	99.7	99.9
1,600.0	26.7	46.2	60.6	71.1	78.8	95.5	99.1	99.8	100.0
1,700.0	28.3	48.6	63.2	73.6	81.1	96.4	99.3	99.9	100.0
1,800.0	30.0	51.0	65.7	76.0	83.2	97.2	99.5	99.9	100.0
1,900.0	31.7	53.3	68.1	78.2	85.1	97.8	99.7	100.0	100.0
2,000.0	33.3	55.6	70.4	80.3	86.8	98.3	99.8	100.0	100.0

Source: Department of the U.S. Air Force: *Tables of Probabilities*

though his sample does not include them, he must decide how they affect the financial statements. If he knows they exist, he cannot just ignore them.

The auditor's use of statistical sampling in testing the financial records will be impressive to his clients. Most of the auditor's clients will be making use of statistical theory in their operations and will have confidence in it. They will probably feel that the auditor is being much more scientific in testing the financial records when he uses statistical sampling methods.

8. TRAINING OF THE AUDITOR

Business requirements of future are going to force the accountant to become familiar with statistical sampling methods. Statistical methods have been accepted by businessmen in the operation of businesses. They are going to demand that the auditor begin using methods which are more objective in testing the financial records.

In order for the auditor to use this scientific method of sampling in his audits, he must become more familiar with statistical theory. As has been shown in this paper, the auditor does not have to be a statistician in order to use these methods.

I feel that College and University accounting requirements should emphasize the need for a good background in the area of statistics. Auditing courses should show accounting students how they can use the statistical theories they learned in statistics courses in the auditing process.

College accounting professors are going to have a great influence on the use of statistical sampling methods in auditing. By influencing today's accounting students that statistical methods can be advantageously used in auditing, it will not be many years before this will be a common audit tool.

9. CONCLUSION

Statistical sampling methods can be advantageously used to test financial data in forming an opinion as to the fairness of the financial statements. These methods are objective and are based upon the laws of mathematical probability. These methods help to prevent bias from entering into the sample which is always a problem when the sample is gathered by means of a judgment decision.

The theory of statistical sampling is based upon the idea that each item in the population has an equal chance of being included in the sample. This is accomplished by the means of a random sample. Random sampling has three distinct advantages. The sample is representative of the entire population

Sample	Probability, in Percent, of Finding at Least One Error if Total No. of Errors in Universe is as Indicated								
	Total Errors in Universe Size of 6,000.								
30	40	50	75	100	200	300	500	1,000	2,000
2.5	3.3	4.1	6.1	8.1	15.6	22.6	35.3	59.8	86.8
4.9	6.5	8.0	11.8	15.5	28.8	40.2	58.1	83.9	98.3
7.3	9.6	11.8	17.2	22.3	39.9	53.7	72.9	93.5	99.8
9.6	12.5	15.4	22.3	28.6	49.3	64.2	82.5	97.4	100.0
11.8	15.4	18.9	27.0	34.4	57.2	72.3	88.7	99.0	100.0
14.0	18.2	22.2	31.5	39.7	63.9	78.6	92.7	99.6	100.0
16.1	20.9	25.5	35.7	44.6	69.6	83.5	95.3	99.8	100.0
18.2	23.5	28.5	39.6	49.1	74.3	87.2	97.0	99.9	100.0
20.3	26.1	31.5	43.3	53.2	78.4	90.1	98.0	100.0	100.0
22.2	28.5	34.3	46.8	57.0	81.8	92.4	98.7	100.0	100.0
24.2	30.9	37.0	50.1	60.5	84.6	94.1	99.2	100.0	100.0
26.1	33.2	39.6	53.2	63.7	87.1	95.5	99.5	100.0	100.0
27.9	35.4	42.1	56.0	66.7	89.1	96.5	99.7	100.0	100.0
29.7	37.6	44.5	58.8	69.4	90.8	97.3	99.8	100.0	100.0
31.5	39.6	46.8	61.3	71.9	92.3	97.9	99.9	100.0	100.0
33.2	41.6	49.0	63.7	74.2	93.5	98.4	99.9	100.0	100.0
34.9	43.6	51.1	65.9	76.3	94.5	98.8	99.9	100.0	100.0
36.5	45.5	53.2	68.0	78.2	95.4	99.0	100.0	100.0	100.0
38.1	47.3	55.1	70.0	80.0	96.1	99.3	100.0	100.0	100.0
39.7	49.1	57.0	71.9	81.6	96.7	99.4	100.0	100.0	100.0
46.9	57.0	65.3	79.6	88.0	98.6	99.8	100.0	100.0	100.0
53.3	63.8	71.9	85.2	92.2	99.4	100.0	100.0	100.0	100.0
58.9	69.5	77.4	89.3	94.9	99.8	100.0	100.0	100.0	100.0
63.9	74.3	81.8	92.3	96.7	99.9	100.0	100.0	100.0	100.0
68.3	78.4	85.3	94.4	97.9	100.0	100.0	100.0	100.0	100.0
72.2	81.9	88.2	96.0	98.6	100.0	100.0	100.0	100.0	100.0
75.6	84.8	90.5	97.1	99.1	100.0	100.0	100.0	100.0	100.0
78.6	87.2	92.4	97.9	99.4	100.0	100.0	100.0	100.0	100.0
81.3	89.3	93.9	98.5	99.6	100.0	100.0	100.0	100.0	100.0
83.6	91.0	95.1	98.9	99.8	100.0	100.0	100.0	100.0	100.0
85.6	92.5	96.1	99.2	99.9	100.0	100.0	100.0	100.0	100.0
87.4	93.7	96.9	99.5	99.9	100.0	100.0	100.0	100.0	100.0
89.0	94.8	97.5	99.6	99.9	100.0	100.0	100.0	100.0	100.0
90.4	95.6	98.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0
91.6	96.3	98.4	99.8	100.0	100.0	100.0	100.0	100.0	100.0
92.7	97.0	98.7	99.9	100.0	100.0	100.0	100.0	100.0	100.0
94.5	97.9	99.2	99.9	100.0	100.0	100.0	100.0	100.0	100.0
95.8	98.5	99.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
96.8	99.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0
97.6	99.3	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
98.2	99.5	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
98.6	99.7	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.0	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.2	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
99.4	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 3. *Discovery Sampling Table.*

Sample Size	Probability, in Percent, of Finding at Least One Error if Total No. of Errors in Universe is as Indicated								
	Total Errors in Universe Size of 6,000.								
	1	2	3	4	5	10	15	20	25
5.0	0.1	0.2	0.2	0.3	0.4	0.8	1.2	1.7	2.1
10.0	0.2	0.3	0.5	0.7	0.8	1.7	2.5	3.3	4.1
15.0	0.3	0.5	0.7	1.0	1.2	2.5	3.7	4.9	6.1
20.0	0.3	0.7	1.0	1.3	1.7	3.3	4.9	6.5	8.0
25.0	0.4	0.8	1.2	1.7	2.1	4.1	6.1	8.0	9.9
30.0	0.5	1.0	1.5	2.0	2.5	4.9	7.3	9.6	11.8
35.0	0.6	1.2	1.7	2.3	2.9	5.7	8.4	11.1	13.6
40.0	0.7	1.3	2.0	2.6	3.3	6.5	9.6	12.5	15.4
45.0	0.8	1.5	2.2	3.0	3.7	7.3	10.7	14.0	17.2
50.0	0.8	1.7	2.5	3.3	4.1	8.0	11.8	15.4	18.9
55.0	0.9	1.8	2.7	3.6	4.5	8.8	12.9	16.8	20.6
60.0	1.0	2.0	3.0	3.9	4.9	9.6	14.0	18.2	22.3
65.0	1.1	2.2	3.2	4.3	5.3	10.3	15.1	19.6	23.9
70.0	1.2	2.3	3.5	4.6	5.7	11.1	16.2	20.9	25.5
75.0	1.3	2.5	3.7	4.9	6.1	11.8	17.2	22.3	27.0
80.0	1.3	2.6	3.9	5.2	6.5	12.6	18.3	23.6	28.6
85.0	1.4	2.8	4.2	5.5	6.9	13.3	19.3	24.9	30.1
90.0	1.5	3.0	4.4	5.9	7.3	14.0	20.3	26.1	31.5
95.0	1.6	3.1	4.7	6.2	7.7	14.8	21.3	27.4	33.0
100.0	1.7	3.3	4.9	6.5	8.1	15.5	22.3	28.6	34.4
125.0	2.1	4.1	6.1	8.1	10.0	19.0	27.1	34.4	41.0
150.0	2.5	4.9	7.3	9.6	11.9	22.4	31.6	39.8	47.0
175.0	2.9	5.7	8.5	11.2	13.8	25.6	35.9	44.7	52.4
200.0	3.3	6.6	9.7	12.7	15.6	28.8	39.9	49.3	57.2
225.0	3.8	7.4	10.8	14.2	17.4	31.8	43.7	53.5	61.6
250.0	4.2	8.2	12.0	15.7	19.2	34.7	47.2	57.4	65.6
275.0	4.6	9.0	13.1	17.1	20.9	37.5	50.6	60.9	69.1
300.0	5.0	9.8	14.3	18.6	22.6	40.1	53.7	64.2	72.3
325.0	5.4	10.5	15.4	20.0	24.3	42.7	56.7	67.2	75.2
350.0	5.8	11.3	16.5	21.4	26.0	45.2	59.5	70.0	77.8
375.0	6.2	12.1	17.6	22.8	27.6	47.6	62.1	72.6	80.1
400.0	6.7	12.9	18.7	24.1	29.2	49.9	64.5	74.9	82.2
425.0	7.1	13.7	19.8	25.5	30.8	52.1	66.8	77.0	84.1
450.0	7.5	14.4	20.9	26.8	32.3	54.2	69.0	79.0	85.8
475.0	7.9	15.2	21.9	28.1	33.8	56.2	71.0	80.8	87.3
500.0	8.3	16.0	23.0	29.4	35.3	58.1	72.9	82.5	88.7
550.0	9.2	17.5	25.1	31.9	38.2	61.8	76.4	85.4	91.0
600.0	10.0	19.0	27.1	34.4	41.0	65.2	79.5	87.9	92.9
650.0	10.8	20.5	29.1	36.8	43.6	68.3	82.1	89.9	94.3
700.0	11.7	22.0	31.1	39.1	46.2	71.1	84.5	91.7	*95.5*
750.0	12.5	23.4	33.0	41.4	48.7	73.7	86.5	93.1	96.5
800.0	13.3	24.9	34.9	43.6	51.1	76.1	88.3	94.3	97.2
850.0	14.2	26.3	36.8	45.7	53.4	78.3	89.9	95.3	97.8
900.0	15.0	27.8	38.6	47.8	55.6	80.3	91.3	96.1	98.3
950.0	15.8	29.2	40.4	49.8	57.8	82.2	92.5	96.8	98.7

The method was developed in industry to control the inspection of products. The plan is designed so that the sampler can reject bad lots of the product.

The auditor, unlike the industrial sampler, cannot simply reject the population being sampled if the error rate goes beyond a certain point. If he discovers a large number or errors, he must extend his audit procedures to determine the cause of the errors and how they affect the financial statements. The auditor does not know the effect of the errors until he discovers them and then evaluates them.

C. *Discovery Sampling*

Discovery sampling is a method which tries to include in the sample at least one instance of the type of event sought if it occurs with a certain frequency. This method is especially helpful if the auditor suspects that fraud has occurred.

In using this method of sampling, the auditor's major consideration is how many errors he will allow before extending his auditing procedures. As in the other sampling methods, he must determine what precision and confidence level he desires.

By using Table 3, the auditor can determine the sample size that will be required if he desires to discover at least one error in the sample. For example, the auditor wants to determine the number of vouchers he must inspect if there are 6,000 vouchers in the population. In this example the auditor wants to have 95 percent confidence that if more than 25 errors occur, he will be able to find one of them. Table 3 indicates that his sample must be composed of 700 items to be selected on a random basis.

Discovery sampling can also give an estimate as to the degree of error rate. If the auditor did not find any errors in the sample, he could conclude that there was a 95.5 percent probability that there are less than 25 errors in the population. He will have 100 percent assurance that there are not more than 75 errors in the entire population.

7. ADVANTAGES OF STATISTICAL SAMPLING

Statistical sampling in auditing has several advantages. The greatest advantage is that it is an objective sample. If the procedures are correctly followed, a sample based on statistical methods will be representative of the entire population. The sample is not subject to bias which is a defect in judgment sampling.

Statistical sampling requires that the auditor plan his audit in advance. He must decide what he expects to accomplish by examining the records of a company. He could be looking for evidence of fraud or he could be trying to estimate the value of a group of accounts. In using statistical methods, the auditor must decide what his objective is before he begins testing.

Statistical sampling allows the auditor to determine the size of the sample needed in an objective manner. The auditor does not have to guess the number of sample items required. He can decide the degree of assurance he wants from the sample and then calculate the sample size required at this confidence level.

Statistical sampling will usually save the auditor time and thus save his client in terms of fees. Since the auditor can take the sample in an objective manner, he can gather the sample faster than if he had to go through the accounts picking the unusual ones. Also since he can calculate the sample size objectively, he will not waste time by over-sampling the population.

Many auditors have argued that statistical methods replace the judgment of the auditor. I feel that these methods help aid his judgment. The auditor must still evaluate the activities of the company and consider what he has learned about the company from past experience in determining the amount of risk he is willing to take. He must decide the precision and confidence level he desires based upon his evaluation of the system of internal control. If the auditor knows that certain errors exist in the population even

he should decide upon the maximum rate of error occurrence. This decision will be based upon his evaluation of the system of internal control and upon previous experience in auditing the company. The auditor must also decide upon the precision and confidence level he desires. This decision will also be based upon the evaluation of the system of internal control.

For example, suppose the auditor wanted to know the error rate in the handling of the 3,000 sales returns and allowances documents. Suppose also that the auditor wants a precision of 3 percent (plus and minus) and a confidence level of 95 percent. The auditor estimates that the maximum error rate will not be over 10 percent. By using Table 2, it can be determined that the sample size required is 341 items to be selected randomly.

After the sample is randomly taken, the auditor divides the number of errors by the sample size to get the rate of error occurrence. The auditor will then decide whether this error rate is acceptable to him. If it is not acceptable, he can expand the sample size and randomly sample more items.

Attribute estimation is one of the best sampling plans for testing the system of internal control. Earlier discussion showed that the American Institute of CPA's feels that statistical sampling methods can be used in testing internal control. Attribute estimation allows the auditor to determine the strength or weakness and the amount of reliance he can place upon the system of internal control because it provides an objective method for estimating the rate of errors in the total population.

Dinar Value Estimation. Dinar value estimation sampling is designed to provide an estimate of the average value of the total population at a certain confidence level by the means of the sample. The average value of the sample, which is randomly selected, must first be determined. This average value is then multiplied by the number of items in the population to determine the estimated value of the population. The auditor usually states the precision in this type of sampling in a dinar value. For example, it could be estimated that the value of accounts receivable is LD500,000 with a precision of 2 percent or LD10,000 (plus or minus). This means that the value of the accounts receivables is somewhere between LD490,000 and LD510,000.

In estimating the dinar value of the total population, the auditor must be careful that all the items in the population are similar. If there is a wide range between items in the population, the auditor should use stratified sampling and make a dinar estimate of each strata and then combine the several estimates to get the estimate for the entire population.

Unless the auditor is extremely familiar with the subject of statistics, he should get an experienced statistician to help him with this type of sampling since it is much more complicated than the discussion here.

B. *Acceptance Sampling*

Acceptance sampling is the method of sampling whereby the auditor decides if he will accept the sample or reject it. The auditor sets a limit on the number of errors he will allow. If fewer than the specified number of errors are found in the sample, the population will be accepted, but if more than the specified number of errors are found, the sample will be rejected. When the sample is rejected, the auditor will have to extend his tests of the population or qualify his report.

Acceptance sampling does not provide any estimate of the frequency of the errors in the population as estimation sampling does. It only tells whether the population is good or bad.

When statistical sampling methods were first discussed in accounting literature, acceptance sampling was highly recommended for auditing purposes. Today, after other methods have been sufficiently developed, it is not used widely by auditors.

Acceptance sampling has one major disadvantage when used for auditing purposes.

TABLE D–2C

Sample Sizes for Sampling Attributes
for Random Samples Only
Expected Rate of Occurrence Not over 10%
or Expected Rate of Occurrence Not Less than 90%
Confidence Level 95% (Continued)

Population Size	Sample Size for Reliability of: ±.5%	±1%	±1.5%	±2%	±2.5%	±3%	±4%
2,500			952	642	453	333	199
2,600			969	649	457	335	200
2,700			983	655	460	336	200
2,800			996	661	462	338	201
2,900			1,008	666	465	339	201
3,000			1,020	671	468	*341*	202
3,100			1,031	676	470	342	202
3,200			1,042	681	472	343	202
3,300			1,052	685	474	344	203
3,400			1,062	689	476	345	203
3,500		1,739	1,068	693	478	346	204
3,600		1,764	1,077	697	480	347	204
3,700		1,787	1,086	701	482	348	204
3,800		1,810	1,095	704	483	349	204
3,900		1,833	1,103	708	485	350	205
4,000		1,855	1,111	711	486	351	205
4,100		1,876	1,118	714	488	351	205
4,200		1,896	1,126	717	489	352	206
4,300		1,917	1,133	720	491	353	206
4,500		1,955	1,146	725	493	354	206
4,700		1,992	1,159	730	495	355	207
4,900		2,027	1,170	735	498	356	207
5,000		2,044	1,176	737	499	357	207
5,500		2,123	1,202	747	503	359	208
6,000		2,194	1,224	756	507	361	209
6,500		2,257	1,243	763	510	363	209
7,000		2,314	1,261	769	513	364	210
7,500		2,367	1,276	775	516	365	210
8,000		2,414	1,290	780	518	367	210
8,500		2,453	1,302	785	520	368	211
9,000		2,493	1,313	789	522	368	211
9,500		2,535	1,323	792	523	369	211
10,000		2,569	1,332	796	525	370	212
10,500		2,601	1,341	799	526	371	212
11,000		2,631	1,349	801	527	371	212
11,500		2,658	1,356	804	528	372	212
12,000		2,684	1,363	806	529	372	212
12,500		2,708	1,369	808	530	373	212
13,000		2,731	1,375	810	531	373	213
13,500		2,752	1,380	812	532	374	213
14,000	6,957	2,773	1,385	814	533	374	213
14,500	7,079	2,792	1,390	816	533	375	213

TABLE D–2C

Sample Sizes for Sampling Attributes
for Random Samples Only
Expected Rate of Occurrence Not over 10%
or Expected Rate of Occurrence Not Less than 90%
Confidence Level 95%

Population Size	Sample Size for Reliability of: ±.5%	±1%	±1.5%	±2%	±2.5%	±3%	±4%
250							116
300							126
350							134
400						196	141
450						207	146
500						217	151
550						226	155
600					283	234	159
650					299	242	162
700					309	248	165
750					319	254	168
800					328	260	170
850					336	265	172
900				441	343	269	174
950				453	350	274	176
1,000				464	357	278	178
1,050				474	363	281	179
1,100				484	369	285	181
1,150				494	374	288	182
1,200				503	379	291	183
1,250				511	384	294	184
1,300				519	389	297	185
1,350				527	393	299	186
1,400				535	397	302	187
1,450				542	401	304	188
1,500				549	405	306	189
1,550			772	555	408	308	190
1,600			784	561	412	310	190
1,650			796	567	415	312	191
1,700			808	573	418	313	192
1,750			819	579	421	315	192
1,800			829	584	424	317	193
1,850			840	589	426	318	194
1,900			850	594	429	320	194
1,950			860	599	431	321	195
2,000			869	604	434	322	195
2,100			888	612	438	325	196
2,200			905	621	443	327	197
2,300			922	628	446	329	198
2,400			937	636	450	331	198

Source: Arkin, Herbert. *Handbook of Sampling for Auditing and Accounting.*

376	68921	31331	79227	05748	51276	57143	31986	99915	45821	97702	87125	44488	77613	56823
377	36458	28285	30424	98420	72925	40729	22337	48293	86847	43186	42951	37804	85129	28993
378	95752	96065	36847	87729	81679	59126	59437	33225	31280	41232	34750	91097	60752	69783
379	26768	02513	58454	56958	20575	76746	49878	06846	32828	24425	30249	78801	26977	92074
380	42613	72456	43636	58085	06766	60227	96414	32671	45587	79620	84831	38156	74211	82752
381	95457	12176	65482	25596	02678	54592	63607	82096	21913	75544	55228	89796	05694	91552
382	95276	67524	63564	95958	39750	64379	46059	51666	10433	10945	55306	78562	89630	41230
383	66954	53574	64776	92345	95110	59448	77249	54044	67942	24145	42294	27427	84875	37022
384	17457	44151	14113	62462	02798	54977	48349	66738	60184	75679	38120	17640	36242	99357
385	03704	23322	83214	59337	01695	60666	97410	55064	17427	89180	74018	44865	53197	74810
386	21538	16997	33210	60337	27976	70661	08250	69599	60264	84549	78007	88450	06488	72274
387	57178	16739	98310	70348	11317	71623	55510	64756	87759	92354	78694	63638	80939	98644
388	31048	40058	94953	55866	96283	46620	52087	80817	74533	68407	55862	32476	19326	95558
389	69799	83300	16498	80733	96422	58078	99643	39847	96884	84657	33697	39578	90197	80532
390	90595	65017	59231	17772	67831	33317	00520	90401	41700	95510	61166	33757	23279	85523
391	33570	34761	98939	78784	09977	29398	93896	78227	90110	81378	96659	37008	04050	04228
392	15340	82760	57477	13898	48431	72936	78160	87240	52716	87697	79433	16336	52862	69149
393	64079	07733	36512	56186	99098	48850	72527	08486	10951	26832	39763	02485	71688	90936
394	63491	84886	67118	62063	74958	20946	28147	39338	32169	03713	93510	61244	73774	01245
395	92003	76568	41034	28260	79708	00770	88643	21188	01850	69689	49426	49128	14660	14143
396	52360	46658	66511	04172	73085	11795	52594	13287	82531	04388	64693	11934	35051	68576
397	74622	12142	68355	65635	21828	39539	18988	53609	04001	19648	14053	49623	10840	31915
398	04157	50079	61343	64315	70836	82857	35335	87900	36194	31567	53506	34304	39910	79630
399	86003	60070	66241	32836	27573	11479	94114	81641	00496	36058	75899	46620	70024	88753
400	41266	80187	20351	09636	84668	42486	71303	19512	50277	71508	20116	79520	06269	74173

Source: Interstate Commerce Commission: *Table of 105,000 Random Decimal Digits,* 1949.

TABLE 1. *Table of Random Numbers.*

Col. / Line	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
351	06433	80674	24520	18222	10610	05794	37515	48619	62866	33963	14045	79451	04934	45576
352	39298	47829	72648	37414	75755	04717	29899	78817	03509	78673	73181	29973	18664	04555
353	89884	59651	67533	68123	17730	95862	08034	19473	63971	37271	31445	49019	49405	46925
354	61512	32155	51906	61662	64130	16688	37275	51262	11569	08697	91120	64156	40365	74297
355	99653	47635	12506	88535	36553	23757	34209	55003	96275	26130	47949	14877	69594	83041
356	95913	11085	13772	76638	48423	25018	99041	77529	81360	18180	97421	55541	90275	18213
357	55864	44004	13122	44115	01601	50541	00147	77685	58788	33016	61173	93049	04694	43534
358	35334	82410	91601	40617	72876	33967	73830	15405	96554	88265	34537	38526	67924	40474
359	57729	88646	76487	11622	96297	24160	09903	14047	22917	60718	66487	46346	30949	03173
360	86648	89317	63677	70119	94739	25875	38829	68377	43918	77653	04127	69930	43283	35766
361	30574	06039	07967	32422	76791	39725	53711	93385	13421	67957	20384	58731	53396	59723
362	81307	13114	83580	79974	45929	85113	72268	09858	52104	32014	53115	03727	98624	84616
363	02410	96385	79007	54939	21410	86980	91772	93307	34116	49516	42148	57740	31198	70336
364	18969	87444	52233	62319	08598	09066	95288	04794	01534	92058	03157	91758	80611	45357
365	87863	80514	66860	62297	80198	19347	73234	86265	49096	97021	92582	61422	75890	86442
366	68397	10538	15438	62311	72844	60203	46412	65943	79232	45702	67055	39024	57383	44424
367	28529	45247	58729	10854	99058	18260	38765	90038	94209	04055	27393	61517	23002	96560
368	44285	09452	15867	70418	57012	72122	36634	97283	95943	78363	36498	40662	94188	18202
369	86299	22510	33571	23309	57040	29285	67870	21913	72958	75637	99936	58715	07943	23748
370	84842	05748	90894	61658	15001	94055	36308	41161	37341	81838	19389	80336	46346	91895
371	56970	10799	52098	04184	54967	72938	56834	23777	98392	31417	98547	92058	02277	50315
372	83125	85077	60490	44369	66130	72936	69848	59973	08144	61070	73094	27059	69181	55623
373	55503	21383	02464	26141	68779	66388	75242	82690	74099	77885	23813	10054	11900	44653
374	47019	06683	33203	29608	54553	25971	69573	83854	24715	48866	65745	31131	47636	45137
375	84828	61152	79526	29554	84580	37859	28504	61980	34997	41825	11623	07320	15003	56774

C. *Stratified Sampling*

Often the total population is composed of items whose values differ extremely. The auditor might want to inspect all the large material accounts and only a certain percentage of the other accounts. He can accomplish this by stratification.

Stratified sampling consists of dividing the entire population into strata and randomly sampling within each stratum. For example, if in the auditing of accounts receivables it is found that 80 percent of the value of the receivables is represented by 5 percent of the accounts, the auditor could stratify the accounts to obtain a more representative sample. The auditor could examine all of the accounts of LD10,000 or over; 20 percent of the accounts with balances between LD5,000 and LD10,000 on an unrestricted random basis; and 1 percent of the accounts with balances under $5,000 on an unrestricted random basis. This stratified sample of the accounts would be more representative of the entire population than if the total population were sampled on an unrestricted random basis.

D. *Cluster Sampling*

Cluster sampling consists of examining groups of sample items on a random basis. It may be accomplished by use of random numbers. The random number that is drawn is matched with the account number as in the case of unrestricted random sampling, and then this account and a certain number of accounts following it will be included in the sample.

For example, say a population of 4,000 vouchers is to be examined. A sample size of 200 is desired, and 20 clusters are wanted. This requires that 20 random numbers be selected. Then as each account is selected, the nine accounts following the randomly selected account would be included in the sample.

Cluster sampling is advantageous in that it requires less time in taking the sample. This advantage is offset though because each cluster must be evaluated on an individual basis.

6. SAMPLING PLANS

Several sampling plans have been developed for use in auditing. Each plan is designed for a specific audit purpose, and therefore, the auditor must determine his objective for taking the sample before he decides upon the plan to use.

The auditor's purpose may be to test the extent of failures to conform with internal control procedures. He may be trying to estimate the dollar value of a group of accounts. The auditor might be trying to discover fraudulent transactions in the records. He might be trying to determine the rate of occurrence of material errors in the financial records. Before the auditor chooses the sampling plan, he must decide exactly what his objective is in performing the test. This causes the auditor to plan the audit more carefully and to understand what it is to accomplish before the audit or early in it.

Three types of sampling plans will be discussed in the following sections. They are estimation sampling, acceptance sampling, and discovery sampling.

A. *Estimation Sampling*

Attribute Estimation. Attribute estimation is designed to determine the number of times a particular occurrence happens. The auditor usually uses this sampling plan in the determination of error rates. The auditor should have some estimate as to the maximum rate of occurrence happens. The auditor usually uses this sampling plan in the determination of error rates. The auditor should have some estimate as to the maximum rate of occurrence since this can have an affect on the size of the sample.

Table 2 is designed for determining the sample size in attribute estimation. Before the auditor can determine the sample size,

the auditor's tests will be made on a random basis, he will think twice before committing the fraud since he will not know exactly which transactions will be reviewed by the auditor.

Four types of random sampling will be discussed in this paper. They are unrestricted random sampling, systematic random sampling, stratified sampling, and cluster sampling.

A. *Unrestricted Random Sampling*

Unrestricted random sampling is accomplished by completely mixing the items of the entire population and then choosing the sample items by random selection. Since the records of a company can't be shuffled like this to provide a random sample, random number tables have been designed to give the same effect in selecting the items as physical shuffling would provide.

An excerpt from the Interstate Commerce Commission's *Table of 105,000 Random Decimal Digits* is shown in Table 1. The auditor can arrange a sufficient number of digits to equal the length of items numbers to be sampled. The table is arranged in blocks of five digits which is for convenience in reading instead of a listing of random five digit numbers.

For example, the auditor in testing accounts receivables may want to test 400 accounts to see that the transactions have been properly recorded. The account numbers range from 101 to 4,999. This indicates that a four digit number will be used. The auditor can begin with any number on the page. In this sample say the auditor chose 0796 (Line 366, Column 4) as the starting point. The first account to be included in the sample would be account # 796. The auditor would then read the next line which gives 8358. Since this number lies outside the range of the account numbers, it is ignored, and the auditor goes to the following number. In this sample, the second account to be tested would be account # 1543. The auditor would continue selecting the sample in this manner until he has 400 accounts.

Unrestricted random sampling is used when the population is numbered. If the population is not numbered, systematic random sampling may be used to obtain the sample.

B. *Systematic Sampling*

When items of the population are not numbered, systematic sampling can be used by the auditor. Systematic random sampling consists of selecting every *nth* item in the population after the first sample item has been selected randomly. The sampling interval is determined by dividing the total population by the sample size.

For example, suppose the auditor wants a sample of 200 items in a voucher file containing 6,000 vouchers. The sampling interval would be 30. The auditor would randomly select an item between 1 and 30. This would be the first sample item. From then on the auditor would select the *30th* voucher. In this sample say that the number selected randomly is 14. The 14*th* voucher in the file becomes the first sample item. The next item to be included in the sample is the 44*th* voucher. This process is continued until the auditor has sampled the entire file.

Systematic sampling also has a definite weakness. Bias may be inadvertedly introduced into the sample. For example, if the auditor is sampling payroll records, his sample could be composed of only the payroll records of one employee. The auditor must study the situation carefully in deciding how to take the sample so that it will be representative of the whole group.

Another example of bias entering the sample is when space for new accounts is left at regular intervals by leaving certain numbers unused. This could cause the sample to be composed of only new accounts or none at all. This problem could be curtailed by having several random starting points in gathering sample items.

a given event out of the several events which may occur."[5] In order to better explain probability, the standard classroom example of drawing a card from a deck of cards will be used. The probability of drawing a diamond from a deck on the first try is thirteen chances in fifty-two or 25 percent since a diamond can occur thirteen times out of fifty-two possible occurrences. As applied to auditing, mathematical probability will allow the auditor to make an objective inference about the entire population based on the number of inaccurate items found in the sample.

In order to make this inference about the population, the auditor must determine the precision limit and confidence level he desires. The precision is the plus or minus range from the sample results within which the true value of the population may be expected to lie. The precision can be expressed as a percentage or in terms of Dinars. For example, in taking a sample it was determined that there was a 5 percent error rate in the sample. If the sampling plan called for a precision of 2 percent, then it could be concluded that for the entire population the number of errors was somewhere between 3 percent and 7 percent of the population.

The confidence level is the level of risk that the sample is representative of the entire population. Walter Meigs has defined confidence level as the measure of the likelihood that the answer will fall within the range provided by the precision. The confidence level is always expressed as a percentage. Usually the auditor will desire between a 90 percent and 99.7 percent confidence level. Unless a 100 percent audit is made, there is always the possibility that the value of the total population will differ from the sample value. The confidence level assures the auditor that the sample is representative of the population.

The auditor's judgment is extremely important in determining the precision limit and the confidence level. He must determine the risk he is willing to take in each part of the audit. The auditor will decide the confidence level he can be satisfied with after he has carefully evaluated the client's system of internal control.

Scientific sampling is based on the theory that each item of the population has an equal chance of being selected. Random sampling which is discussed in the following section provides this objective method of gathering the sample.

5. RANDOM SAMPLING

The theory of statistical sampling requires that the sample items be gathered on an objective basis. With random sampling, each item in the total population has the same probability of being included in the sample.

The theory of statistical sampling will not accept a sample determined by the traditional audit method of a judgment decision because this method lacks objectivity. Even though the auditor tries to be objective in choosing the items to include in the sample on a judgment basis, personal bias will still often cause the auditor to select certain items. This will cause the sample to fail to be a probability sample.

It should be emphasized here that the auditor can use random sampling methods without using other statistical methods which will be discussed in the next major section. Random sampling provides a method for the auditor to gather evidential matter on all his audits in an objective manner.

Random sampling has several advantages over non-scientific sampling methods. It provides assurance that the sample items are representative of the entire universe. By being representative, it allows the auditor to make objective inferences about the entire population. It guarantees that personal bias will not affect the sampling process. Random sampling also provides a surprise element in auditing which can deter fraud. If an individual considering fraud knows that

[5] Francis J. Schaefer, "Statistical Sampling – An Audit Tool," *The New York Certified Public Accountant*, Vol. XXXIII (November, 1963), p. 778.

3. TRADITIONAL SAMPLING METHOD

When accountants first began auditing financial records, they checked each transaction to see if it was accurate. As the size of business grew rapidly, the auditor had to drop the 100 per cent examination method for a method which would save time yet give him a basis for his opinion. Auditors then began using the test check method to gather evidential matter. The test check method allows the auditor to test only a few items in order to form his opinion on the fairness of the financial statements.

Traditionally the auditor has decided which items are to be examined on the basis of a judgment decision. The auditor chooses the items he wants to inspect. There are no set of standards as to which transactions the auditor will choose.

The auditor usually tries to select those items which seem to be inaccurate or which create a doubt in his mind. He does this by choosing the items in an account which seem too large or too small in relation to the other items in the account. His sample is based on items which he feels are deviant from the norm even though these items may be correct. The auditor's judgment is not always correct about items which are inaccurate because his judgment is subject to personal prejudices and bias. The following example shows how the opinion of auditors differs as to the items to be tested:[4]

> *An experiment was conducted on the judgmental selection of bank depositor's accounts for written confirmation. Four experienced auditors were given the same criteria for selecting accounts from a ledger tray containing some 300 accounts, and each auditor made his own selection from the complete tray of ledger cards. Ideally, each auditor should have selected the same accounts, but there was actually agreement on only 10% of the total accounts selected by the four.*

Another method of selecting the sample items on the basis of a judgment decision is the black sample. Usually all the items in a given period of time are examined. The basic disadvantage with this method is that just because all the items for one selected period are accurate, there is no assurance that the transactions for the other period are completely correct.

Sampling based upon judgment decisions is dependent upon the training and the carefulness of the auditor. If the auditor taking the sample is a young staff assistant, his ideas about the items to be tested will usually differ from those of the more experienced auditor. The experienced auditor will have a more experienced opinion in selecting the items to be tested than the young staff assistant will.

Another disadvantage of judgment samples is that there is no accurate method for determining the sample size. The auditor must make the decision as to the number of items to be tested, and he may either over-estimate or under-estimate the number of items to be tested. Again the experience factor will have a great influence on determining the sample size on a judgment basis. The sample can be more reliable if it is based upon a more scientific sampling method.

4. SCIENTIFIC SAMPLING

Scientific sampling differs from judgment samples in that it is based upon mathematical probability. It is an objective sample which is more representative of the entire population, and therefore, more reliance can be placed upon it by the auditor in forming his opinion.

The theory of probability will be dealt with very briefly in this paper since a full discussion would go beyond the scope of this paper. Probability has been defined by Francis Schaefer as "a statement in mathematical terms of the expected rate of occurrence of

[4] Howard F. Stettler, "Statistical Sampling Techniques," *Accountant's Encyclopedia*, Vol. III, Englewood, Cliffs, N. J.: Prentice Hall, Inc., 1962, p. 923.