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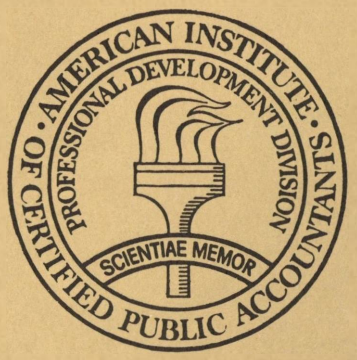
Auditor's Approach to Statistical Sampling, Volume 4. Discovery Sampling

American Institute of Certified Public Accountants. Professional Development Division. Individual Study Program

4

AN AUDITOR'S APPROACH TO STATISTICAL SAMPLING

DISCOVERY SAMPLING



Individual Study Program
Professional Development Division
American Institute of Certified Public Accountants

NOTICE TO READERS

This programed learning text is a publication of the staff of the American Institute of Certified Public Accountants and is not to be regarded as an official pronouncement of the Institute. It was prepared by Teaching Systems, a service of The New York Times, programing consultants, William H. Piercy, CPA, and Morton J. Rossman, CPA, and Thomas R. Hanley, CPA, Manager, Special Projects. The members of the Committee on Statistical Sampling assisted in an advisory capacity.

AN AUDITOR'S APPROACH TO STATISTICAL SAMPLING

Volume 4

DISCOVERY SAMPLING

Programed for the
American Institute of Certified Public Accountants
by
Teaching Systems
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PREFACE

The Committee on Statistical Sampling of the American Institute of Certified Public Accountants has undertaken the development of a series of programed texts on statistical sampling techniques in auditing to broaden education in this area.

This volume, the fourth in the series of programed texts, deals with the probabilities of rare items being included in samples. Sampling, with the objective of evaluating the existence of rare items, is referred to as discovery sampling or exploratory sampling.

Earlier volumes in the series, *An Introduction to Statistical Concepts and Estimation of Dollar Values* (Volume 1) and *Sampling for Attributes* (Volume 2), cover certain basic statistical concepts and sampling for particular characteristics measured either quantitatively in terms of dollar values or qualitatively in terms of frequency of occurrence. Because Volumes 1 and 2 serve as introductory material for Volume 4, the reader should have completed those volumes. No attempt has been made to explain the mathematics and theory underlying the tables used in this volume, nor have criteria been suggested or established for statistical precision and reliability. Precision and reliability are subjective determinations and should be based upon the judgment of the auditor. Examples of statistical sampling applications have been constructed for teaching purposes only and no implication should be drawn that the techniques discussed in this volume provide the sole means of making estimates in similar situations.

The tables in this volume relating to probability of including at least one occurrence in a sample were developed by applying the formulas for evaluation of the binomial distribution for populations over 10,000 and the hypergeometric probability distribution for smaller populations. Acceptable approximating methods of calculating the probabilities using the hypergeometric have been developed which reduce human mechanical calculation time from near infinity to a reasonable number of minutes. One such method is presented in the Supplementary Section. Other tables in Volume 4 have been carried forward from Volume 2.

Discovery sampling augments sampling for attributes and as such may be used in combination with attribute sampling. The determination as to whether statistical sampling is appropriate in the circumstances must be made in each instance by the auditor based on his knowledge and judgment.

This volume is the result of a joint effort on the part of the entire (1967-1968) Committee on Statistical Sampling with the assistance of Thomas R. Hanley, CPA, Manager, Special Projects. However, special acknowledgement is made of the contribution of two of its members, William H. Piercy, CPA, and Morton J. Rossman, CPA, to the content and for coordination with the chief programing consultant, John C. Gill, Jr., Teaching Systems, a service of The New York Times.

This booklet is being made available to the Institute membership as part of the continuing education programs of the Professional Development Division.

RICHARD A. NEST, CPA
Director of Technical Services

December, 1968

INTRODUCTION

Discovery Sampling is a "programed instruction" text. The essential feature of this relatively new method is a step-by-step aproach that requires the reader to absorb each point thoroughly before going on to the next. You will notice that the pages are divided into three "frames." Most frames require you to answer a question, or work out a problem, in addition to reading the material. Complete instructions are given below.

Although this method may seem slow at first, it virtually guarantees that the reader who conscientiously works through each frame will, upon completing the book, be able to solve problems, answer questions, and perform tasks that involve all the knowledge required for applying the concepts taught to actual auditing situations. The reader who has invested the time required in the prescribed manner will be able to work out field problems of this nature without further instruction.

The text has been designed to follow previous volumes in this series, particularly Volume I, *An Introduction to Statistical Concepts and Estimation of Dollar Values,* and Volume II, *Sampling for Attributes.* It is assumed that the reader has an understanding of the concepts taught in those volumes. As in Volumes I and II, certain frames have been designated to be skipped by the reader who has evidenced mastery of the topic under discussion. However, except for these clearly specified cases, maximum value will be obtained from this book only by going through each frame according to the sequence "programed" by the authors. If the early chapters seem relatively easy, it is only in order that the reader will be fully prepared for the more difficult later chapters.

INSTRUCTIONS FOR USE

A. Programed Text

Each frame contains either a *blank* to fill in, a *choice* to circle, a *direction* to do an exercise or read an Exhibit in the Supplementary Section, or the phrase "No answer required." In the latter case, simply read the material and go on to the next frame. The "no answer" frames are, however, as important in the teaching sequence as the others, and usually are followed up with a question in a later frame.

If an answer is required, write it directly in the space provided. When a choice is given, it is recommended that you circle the correct one rather than crossing out the wrong one or answering mentally. All questions are designed to be answered easily, based on the material immediately preceding or on your own judgment. The correct answer appears on the following page in the space adjacent to the next frame. If your response is incorrect, you are advised to cross it out and substitute the correct one.

A special format used occasionally is the "branching" frame. This consists of a multiple-choice question together with an instruction to turn to a specified frame depending on the answer you give. Except for these clearly indicated cases, however, all answers appear on the page immediately following the question and should be checked before you proceed to the next frame.

The frames are not to be read *down* the page, but rather go in numerical order *across* the book. Thus, every frame in the top row will be read before going on to the middle row.

B. Supplementary Section

The smaller booklet serves as both a workbook and review book, and is also designed to be a reference manual for on-the-job use. The programed text directs you to the relevant pages in this book at the proper time, and it may also be referred to whenever necessary. The individual summaries should be read immediately before and immediately after each chapter.

A NOTE ON CONTENT

This book is not designed to be a statistics course. Rather, it examines in detail one particular statistical technique—discovery sampling—solely for the purpose of aiding in an auditing situation. Mathematical proofs and derivations have been omitted. Even the "basic statistical concepts" have been screened so that only those with practical relevance are covered. Certain basic statistical concepts such as probability theory and small-sample applications are not discussed.

Due to this approach, questions may arise due to curiousity of philosophical considerations while you are going through this book. In additon, questions will almost certainly occur to you having to do with types of situations not included under the topic of unrestricted sampling. The fact that these questions cannot be answered in this book has nothing to do with the method of programed instruction, but rather results from the decision to make this instruction as effective as possible for practical applications with a minimum investment of the reader's time. Questions of this nature, therefore, will either be answered in future volumes in this series, or will remain unanswered without detracting from the book's practical effectiveness.

HOW TO USE THIS MANUAL

This book has been organized in a new method known as "programed instruction." Each page is divided into three paragraphs or "frames." Each one of these frames is numbered. #2 is not below #1. Instead, it is on the following page. #3 is on the page following #2, and so on.

Almost every frame contains a question for you to answer. The most common type of question consists of a blank line for you to fill in. Look at Example 1.

EXAMPLE 1. The name of this book is "_____ Sampling."

You have already seen that the name of this book is "Discovery Sampling," so naturally you would fill in the word "Discovery" in the blank space.

Sometimes part of the word will already be filled in as an extra clue. Two blanks means that two words are called for.

Another type of question consists of a choice for you to circle. Look at Example 2.

EXAMPLE 2. This book (IS/IS NOT) an ordinary book.

You have already read that this book is not an ordinary book, so you would circle the choice as follows: (IS/(IS NOT))

Of course, most of the questions in this book will not be at this level of simplicity. However, there are always a few hints given. If you read carefully you will get the correct answer almost every time.

After you have read the frame and made your response, *turn the page immediately.* You will find the correct answer on the next page. Then you will simply go on to the next frame. Notice that you do *not* read down the page as you would in an ordinary book. After you have finished the top row of frames in each section, you will be directed to go on to the second row.

If an answer of yours proves to be incorrect, cross it out lightly and substitute the correct answer. Please do not erase any of your wrong answers.

Sometimes there will be no answer required from you. In that case, read the paragraph carefully and then, as always turn the page and go on to the next.

Now begin with Chapter 1 on the next page.

CHAPTER 1. DEFINITION OF SAMPLING PROGRAM

1-1. Discovery sampling is a statistical procedure which permits the auditor to estimate the probability of uncovering at least one example of a certain characteristic in a random sample drawn from the population if the true occurrence rate in the population equals or exceeds some specified percentage. Since discovery sampling is concerned with the (OCCURRENCE RATE/DOLLAR VALUE) of a characteristic, it may be considered as a special case of (ATTRIBUTE/VARIABLE) sampling.

CIRCLE YOUR CHOICE AND GO ON TO THE NEXT PAGE.

OCCURRENCE RATE

ATTRIBUTE

(The correct answer always appears in this box.)

Now go on to the frame at the right.

1-2. Discovery sampling is used where the auditor's best initial estimate of the occurrence rate of a certain characteristic is 0% or near 0%. It permits him to design, select, and evaluate a sample to determine, with a specified degree of reliability, that the maximum occurrence rate in the population does not exceed a specified level. If the auditor's initial estimate of the occurrence rate of a certain characteristic is 3% and the maximum acceptable occurrence rate is 5%, he should pursue a(n) (DISCOVERY/ATTRIBUTE) sampling plan.

CIRCLE YOUR CHOICE AND GO ON TO THE NEXT PAGE.

ATTRIBUTE	REMINDER
	As you go through this book, remember that you will ignore the material in the rows above and below the one you are reading. If you make a mistake, the recommended procedure is to go back and cross out your answer and substitute the correct answer. TURN THE PAGE AND GO ON TO #1-3.
	2-26. In the previous example, note that as the maximum tolerable occurrence rate increased and reliability remained constant, the required sample size _____.
	3-31. In specifying his occurrence rate for his sampling plan, the auditor must have some estimate of a maximum acceptable overstatement. In the previous example, the auditor is 95% confident that overstatement due to improper posting does not exceed $49,000 assuming all the worst conditions. He must satisfy himself regarding the materiality of such a conclusion. (No answer required)

Go on to #1-3.	1-3. In discovery sampling, the auditor is usually looking for a characteristic which, if discovered in his sample, might be indicative of more widespread irregularities or serious errors in the financial statements. The discovery of one such error would indicate the need for more extensive tests. (No answer required)
decreased	2-27. In discovery sampling, increasing the maximum tolerable occurrence rate widens the acceptable precision limits of the estimate since the best initial estimate of the frequency of occurrence is constant at ____%.
No answer required	3-32. Review the problem of Worksheet 3, Modern Producers (Page S-40). In his examination of the sample, the auditor finds 3 unauthorized employees in the 460 payroll transactions which he examines. Enter the number of occurrences on Line 5 of Worksheet 3.

No answer required	1-4. If a certain error occurs only once in a population, no sampling program, short of 100% examination, will provide any reasonable assurance of revealing that error. However, with discovery sampling, the auditor may design a sample which will give him a specified degree of confidence that he will uncover at least one error in his sample if the error occurs at some specified rate. Therefore, in discovery sampling, the auditor attempts to find which of the following? a. isolated occurrences of errors b. assurance that errors do not exceed a certain rate
0	2-28. Observe the relation between population size and required sample size in the two following cases: A: Population Size 3,000; Maximum Occurrence Rate 0.5%; Reliability 99%; Sample Size 800 B: Population Size 7,000; Maximum Occurrence Rate 0.5%; Reliability 99%; Sample Size 900 As population size increased from 3,000 to 7,000, the required sample size for a specified maximum occurrence rate and reliability (INCREASED/DECREASED).
5. 3	3-33. Have the criteria of the sampling plan been met? (YES/NO)

b. assurance that errors do not exceed a certain rate	1-5. The statement of a discovery sampling problem should include the following: a. the characteristic to be evaluated b. the specified reliability c. maximum tolerable occurrence rate d. definition of the population Which of these elements is missing from the following statement? _____ "An auditor tests disbursement vouchers to determine whether or not compliance deviations exceed 0.2%."
INCREASED	2-29. The effect of varying population size on the required sample size is relatively less than the effect of varying reliability or the maximum occurrence rate. However, as the previous example illustrates, increasing population size, while holding other factors constant, will tend to _____ the required sample size.
NO	3-34. Can the tables in Exhibit I be used to evaluate the auditor's findings? (YES/NO) Explain your answer. _____ _____

specified reliability (confidence level)	1-6. Read Worksheet 1 (Page S-37) in the Supplementary Section. The <u>population</u> for the discovery sampling problem of Southern Manufacturing Company is which of the following? a. all disbursement vouchers b. all disbursement vouchers over $1,000 c. all disbursement vouchers below $1,000
increase	2-30. Read the problem on Worksheet 3 (Page S-40) in the Supplementary Section, Modern Producers. Complete Lines 1, 2, and 3 of the Worksheet.
NO (The tables only apply where the number of occurrences in the sample is 0.)	3-35. If no errors had been discovered in the sample at Modern Producers, no further analysis would be required to determine whether or not the sampling criteria have been met. (TRUE/FALSE)

c. all disbursement vouchers below $1,000	1-7. Similarly, the characteristic which the auditor seeks to discover must be precisely defined. An error in a disbursement voucher can occur in any of several ways. In the problem of Worksheet 1, assume that a $500 disbursement paid to a painting contractor was posted to the wrong maintenance account. On the income statement, all maintenance accounts are classified into one category, operating expense. Would this be an improper posting according to the statement of the problem? a. Yes (If this is your answer, go to Frame 1-8.) b. No (If this is your answer, go to Frame 1-9.)
1. 2,000 2. 90% 3. 0.5%	2-31. Determine the required sample size for the problem of Modern Producers and enter your answer on Line 4 of the Worksheet.
TRUE	3-36. The tables in Exhibit I are used only if the number of sample errors equals 0. (TRUE/FALSE)

	1-8. YOUR ANSWER: a. Yes This answer is incorrect. Posting to the wrong maintenance account would not affect net income because all maintenance accounts are combined into one figure for reporting purposes. Therefore, it does not meet the definition of an error specified by the auditor. Review Frame 1-7 and select another answer.
4. 460	2-32. In the problem of Modern Producers, the auditor must examine 460 items, or approximately 23% of the population. If his sample were drawn from a population several times as large, the required sample size would be about the same, but the <u>percentage</u> of items would _____.
TRUE	3-37. If an auditor finds no errors in a discovery sample, he can immediately state that the criteria of his sampling program have been met. Further, he can make several separate statements of his reliability that the true population occurrence rate does not exceed certain values. (TRUE/FALSE)

	1-9. YOUR ANSWER: b. No This answer is correct. Since maintenance accounts are combined in the financial statements, posting to the wrong maintenance account will not affect net income. Therefore, it does not meet the definition of an error as stated by the auditor. Continue with Frame 1-10.
decrease (be less)	2-33. If the auditor at Modern Producers had set his maximum tolerable occurrence rate at 1% instead of 0.5%, his sample size would have been reduced from 460 to ____ items.
TRUE	3-38. An auditor selected a sample of 600 items from a population of 8,000 and discovered no errors. He can state with 71% confidence that the true population occurrence rate does not exceed ____% and, with ____% confidence, that it does not exceed 0.5%.

	1-10. According to the problem in Worksheet 1, would an error exist if a disbursement were posted to property, plant, and equipment which should have been posted to maintenance? (YES/NO) Please explain your answer. _____
240	2-34. List the three factors which must be stated to determine the required sample size. 1. _____ 2. _____ 3. _____
0.2% 96%	END OF CHAPTER 3

YES. Net income would be overstated by the amount of the disbursement.

1-11. Identify the improper postings listed below which would be considered errors in the problem of Worksheet 1.

a. A large capital addition improperly posted to repairs.

b. A disbursement for advertising erroneously posted to sales promotion expense.

Population size

Maximum rate of occurrence

Reliability

/ANY ORDER/

2-35. In selecting the required sample size, the population size determines the _____ to be used; the maximum rate of occurrence determines the _____ by which the table is entered; the _____ in which the specified reliability occurs corresponds to the required sample size.

CHAPTER 4. DISCOVERY AND ATTRIBUTE SAMPLING

4-1. In many cases, auditors find it useful to employ discovery sampling in conjunction with attribute sampling plans. One feature which distinguishes discovery sampling from attribute sampling is that the auditor makes some initial estimate of his expected sample error rate in attribute sampling, while in discovery sampling no such estimate is required, since the tables assume an expected error rate of ____%.

a. A large capital addition improperly posted to repairs.	1-12. A characteristic of discovery sampling plans is that the auditor can state his findings with a specified degree of confidence (reliability). In the initial statement of his sampling plan, he must, therefore, specify the _____ he seeks.
table column line	2-36. Indicate with an I the factor(s) below which, when increased, will increase sample size and with a D the factor(s) which will decrease sample size. Assume, in each case, that all other factors remain constant while the factor in consideration is increased. ___ Population size ___ Maximum occurrence rate ___ Reliability
0%	4-2. Typically, in combined applications of discovery and attribute sampling, the auditor uses attribute sampling to evaluate the frequency of non-critical errors and discovery sampling to determine the probability of his sample including at least one occurrence of a critical error if the frequency of critical errors in the population equals or exceeds some specified level. (No answer required)

reliability (confidence)	1-13. In the statement of a discovery sampling plan, the auditor must define his population, define the characteristic he is looking for, specify a _____ level, and specify a maximum acceptable _____ rate.
_I_ Population size _D_ Maximum occurrence rate _I_ Reliability	END OF CHAPTER 2
No answer required	4-3. In any given situation, the distinction between critical and non-critical errors is a function of the auditor's judgment. Critical errors would be serious deviations from internal controls, evidence of irregularities, etc. Deliberately suppressing an invoice in a significant amount would be an example of a (CRITICAL/NON-CRITICAL) error.

confidence (reliability) occurrence	1-14. In the statement of his findings, an auditor concluded that he was 80% confident that the true rate of occurrence of compliance deviations in a certain population does not exceed 1%. This means that, out of 100 random samples drawn from the population, he would expect approximately _____ samples to reveal a frequency of compliance deviations (LESS THAN/EQUAL TO) 1%.
	CHAPTER 3. SAMPLE EVALUATION 3-1. When the sample size has been determined, the auditor must then select, at random, those population elements which will be included in the sample using the procedure detailed in Chapter 2 of Volume I, An Introduction to Statistical Concepts and Estimation of Dollar Values. An alternate acceptable method of sample selection is random systematic sampling which is described in Appendix I of Volume II, Sampling For Attributes. (No answer required)
CRITICAL	4-4. In combined applications, the auditor will approach the problem by using attribute sampling to evaluate non-critical errors and discovery sampling to evaluate _____ errors.

80 LESS THAN	1-15. A precise statement of an auditor's findings from a discovery sampling program which revealed no sample errors would appear as follows: "If the true population rate of occurrence were 1%, there is an 80% probability that at least one error would have been included in the sample." From this statement, he can conclude that he has an 80% _____ that the true population _____ rate does not exceed 1%.
No answer required	3-2. When the sample items have been selected, each is examined for the existence of errors as specified in the sampling problem. Which of the following errors must the auditor consider for the purpose of his stated discovery sampling program? a. Only those errors specifically defined in his problem statement. (If this is your answer, go to Frame 3-3.) b. Any error in the population regardless of nature or cause. (If this is your answer, go to Frame 3-4.)
critical	4-5. Generally, in combined plans, the auditor will design his sample for attribute sampling. In evaluation, if no critical errors are found, he states the probability that his sample would have included at least one critical error if they had occurred at some specified frequency in the population. His evaluation of non-critical errors would be based upon _____ sampling.

confidence (reliability) occurrence (error)	1-16. One feature that distinguishes discovery sampling from attribute sampling is that the auditor's best initial estimate of the occurrence rate in discovery sampling is close to _____%.
	3-3. YOUR ANSWER: a. Only those errors specifically defined in his problem statement. This is correct. Other errors found in the sample might require a separate sample or other auditing program. However, the auditor has pursued his program with a reliability and maximum occurrence rate specified to reflect the relative seriousness of the stated errors. As he uncovers other errors, he might wish to evaluate those errors separately using maximum occurrence rates and reliabilities consistent with the seriousness of the error. Go to Frame 3-5.
attribute	4-6. From a population of 15,000 items, an auditor selects 340 for attribute sampling of non-critical errors. In his analysis of the sample, he notes 3 non-critical errors and no critical errors. He concludes that there is an 82% probability that the true occurrence rate of critical errors in the population is less than 0.5% and a _____% probability that it is less than 1%.

0%	1-17. What four factors must be included in the statement of the discovery sampling plan? 1. _____ 2. _____ 3. _____ 4. _____
	3-4. YOUR ANSWER: b. Any error in the population regardless of nature or cause. This is incorrect. Obviously, an auditor would note any errors found in his sample. However, for evaluating his discovery sampling problem, he would only count those errors defined in the problem statement. Finding other errors, he might well choose to pursue either a separate sampling program with tolerance limits and confidence levels consistent with the seriousness of the error or some other auditing program. Go to Frame 3-5.
97%	4-7. When a sample is selected for a combined program, the requirements of the attribute sampling problem determine the sample size except where a previously specified reliability and maximum occurrence rate of critical errors demands selection of a larger sample. (No answer required)

Population definition

Characteristic (error) definition

Required reliability

Maximum occurrence rate

/ANY ORDER/

END OF CHAPTER 1

3-5. An auditor examines cancelled checks to determine the maximum occurrence rate of errors which could have a monetary effect on the financial statements. Which of the items below constitutes an error for this evaluation?

a. A spoiled check not properly mutilated. (Go to Frame 3-6.)

b. A payroll check drawn in an amount greater than the authorized limit, later approved by a responsible executive. (Go to Frame 3-7.)

c. A check for $10.00 where the value has been raised to $10,000.00. (Go to Frame 3-8.)

No answer required

4-8. The following factors must be specified in the statement of the attribute sampling problem to determine the required sample size.

(1) Upper Limit

(2) Estimated Occurrence Rate

(3) Required Reliability

Which of these three factors is not required to determine the size of a discovery sample? _____ What additional factor must be known to determine the size of a discovery sample? _____

CHAPTER 2. DETERMINATION OF SAMPLE SIZE

2-1. When the auditor has stated his sampling problem, his next step is to determine the required sample size. The sample size can be selected from the tables in Exhibit I (pages S-22 through S-24) of the Supplementary Section. These tables assume that random sampling will be used without replacement.

(No answer required)

3-6. YOUR ANSWER: a. A spoiled check not properly mutilated.

This answer is incorrect. This error probably represents a deviation from internal control procedures. However, it does not necessarily indicate a discrepancy in the financial statements.

Go back to Frame 3-5 and select another answer

Estimated Occurrence Rate

Population size

4-9. Read the problem on Worksheet 4, (Page S-41), Suburban Supply, and complete Lines 1, 2 and 3.

No answer required	2-2. In the tables used for attribute sampling in Volume II, you will recall that population size was not essential to determination of sample size. However, you will note in Exhibit I that each table refers to a different population size. For example, Table I-A (Page S-22) is for populations over 10,000 and Table I-B is for populations between _____ and _____.
	3-7. YOUR ANSWER: b. A payroll check drawn in an amount greater than the authorized limit, later approved by a responsible executive. This answer is incorrect. The fact that the wrong check was used does not change the company's liability for the expense. Therefore, this would not affect the financial statements. Go back to Frame 3-5 and select another answer.
1. 5% 2. 3% 3. 95%	4-10. From the tables for attribute sampling, Determination of Sample Size in Exhibit II (Pages S-25 through S-29), select the correct sample size for the problem of Suburban Supply. Enter your answer on Line 4 of Worksheet 4.

5,000

10,000

2-3. Each of the tables corresponds to a relatively broad range of population size. The auditor can, therefore, select the proper table with a reasonable approximation of the size of the population he is evaluating. Tables I-B and I-C specify upper and lower limits of population size whereas Table I-A applies to all populations consisting of (MORE/LESS) than _____ items.

3-8. YOUR ANSWER: c. A check for $10.00 where the value has been raised to $10,000.00.

This answer is correct. An occurrence such as this not only indicates a deviation from internal control procedures and a potential defalcation, but also would affect the financial statements. The problem specifies "errors which have a monetary effect on the financial statements." From the information given, this is the only error of the three which meets this condition.

Go to Frame 3-9.

4. 460

(If you had this answer correct, go to Frame 4-14. If you were incorrect, continue with Frame 4-11.)

4-11. To determine the required sample size in attribute sampling, select the table in Exhibit II corresponding to the specified reliability. In the problem of Suburban Supply, the specified reliability is _____%. You would, therefore, use Table _____ in Exhibit II.

MORE 10,000	2-4. You will note that the columns in Exhibit I are headed as follows: "If the True Population Rate of Occurrence is: X% The Probability of Including at Least One Occurrence in the Sample is: a% b% etc." The expression "Probability of Including ... " corresponds to (RELIABILITY/PRECISION LIMIT).
	3-9. In discovery sampling, the auditor selects a sample of sufficient size that it will give him a specified degree of confidence that he will uncover at least <u>one</u> error if they occur in the population at a rate equal to or greater than his specified maximum occurrence rate. (No answer required)
95% I-B	4-12. The next step is to locate the column corresponding to the upper limit and proceed down the column until you reach the estimated occurrence rate or the next higher value. For the problem of Suburban Supply, the upper limit is 5% and the estimated occurrence rate is 3%. Therefore, you would go down the _____% column until you reached _____%, the first value which appears in that column equal to, or greater than, the estimated occurrence rate.

RELIABILITY	2-5. To enter the tables, the auditor must select the table corresponding to his _____ _____ and locate the column for his specified maximum occurrence rate (true population rate of occurrence).
No answer required	3-10. Which of the following statements is true? a. If the auditor finds one error, the criteria of his sampling plan have been met. (Go to Frame 3-11.) b. If the auditor finds no errors, the criteria of his sampling plan have been met. (Go to Frame 3-12.)
5% 3.3%	4-13. When the estimated occurrence rate (or next higher value) is located in the proper column, the auditor simply identifies the line in which this occurs to determine his sample size. For the problem of Suburban Supply, the estimated occurrence rate of 3.3% in the 5% upper limit column appears on the line for a sample size of _____ items.

population size	2-6. Read Worksheet 1 (Page S-37) and enter, on Line 1, the correct population size for the discovery sampling problem of Southern Manufacturing Company.
	3-11. YOUR ANSWER: a. If the auditor finds one error, the criteria of his sampling plan have been met. This answer is incorrect. The auditor has based his sample size on the assumption that no errors would be found in the sample. If he discovered one error, he could not state, with his specified reliability, that the population occurrence rate does not exceed his predetermined percentage. Review Frames 3-9 and 3-10 and select another answer.
460	4-14. In evaluating his sample of 460 items, the auditor finds the following errors: 5 receipts posted to the wrong account 12 billings posted to the wrong account 1 receipt posted in the wrong amount All of these errors were determined by the auditor to be non-critical errors. Complete lines 5 and 6 of Worksheet 4.

1. 9,800

(10,300 − 500)

2-7. For the population of Worksheet 1, which table must the auditor use to determine the proper sample size? _____

3-12. YOUR ANSWER: b. If the auditor finds no errors, the criteria of his sampling plan have been met.

This answer is correct. The auditor can state that, had errors occurred at the specified rate, it is X% probable that his sample would have revealed at least one such error. Since no errors are found, he is X% confident that the true population occurrence rate does not equal, or exceed, his specified maximum occurrence rate.

Continue with Frame 3-13.

5. 18

6. 0

4-15. The auditor has found no critical errors in his sample. Therefore, he (CAN/CANNOT) use the discovery sampling tables in Exhibit I for evaluation of critical errors.

Table I-B	2-8. The auditor first selects the table corresponding to the population size. Then he enters the table in the column headed by his specified maximum occurrence rate. On Table I-B (Page S-23) he would select the first column to the right of the sample size if his specified maximum occurrence rate were 0.1% and the next column if his specified maximum occurrence rate were _____%.
	3-13. If no errors are found in the sample, there is no need for further evaluation of the sample. However, reference to the tables can reveal certain other conclusions which may be drawn if no errors are found. As in determination of sample size, the auditor selects the appropriate table in Exhibit I according to _____ _____.
CAN	4-16. Refer to the tables for Evaluation of Results (attributes) in Exhibit II (Pages S-30 through S-34). Has the population met the criteria of the attribute sampling problem? (YES/NO)

0.2%	2-9. The numbers which appear in each column are values of reliability. For example, you will note that the first value which appears in the 0.4% column of Table I-B is 18. This refers to a _____ of 18%.
population size	3-14. In a population of 3000 items, an auditor sought 99% reliability that errors did not exceed 1%. His sample of 460 items, selected at random from the population, revealed no errors. Therefore, his sampling criteria (HAVE/HAVE NOT) been met.
NO	4-17. From the tables in Exhibit III, determine the upper limit of occurrence rate for a 95% reliability and the number of errors found in the sample. Enter your answer on line 7 of Worksheet 4.

reliability	2-10. The auditor must proceed down the column until his specified reliability or the next higher value appears. On Table I-B, for a maximum occurrence rate of 0.5%, and a reliability of 90%, he would go down the columm until he reached 91%, the first value to appear which is greater than, or equal to, 90%. If the specified reliability were 95%, he would continue until he reached _____%.
HAVE	3-15. Since no errors are found in the sample of 460 items, the auditor may make statements corresponding to each probability appearing in the line headed by his sample size. Thus, with no errors in his sample of 460 items, the auditor can state that he is 77% confident that the true rate of occurrence is less than 0.3%, 86% confident that it is less than _____%, and _____% confident that it is less than 0.5%.
7. 6% (If you had this answer correct, go to Frame 4-22. If you were incorrect, continue with Frame 4-18.)	4-18. To evaluate an attribute sample, select the table in Exhibit III (Pages S-30 through S-34) corresponding to the reliability specified in the problem statement. In the case of Suburban Supply, this would be Table 2-B, Reliability: _____%.

96%	2-11. Once his specified reliability (or the next higher value) has been located, he must identify the line in which it appears. The lines are identified in the left-hand column and correspond to the required sample size. On Table I-B, an occurrence rate of 0.5% and a reliability of 70% would require selection of a sample of _____ items.
0.4% 91%	3-16. An auditor evaluates a sample in which no errors are found. The only statement he can make is that the population meets the criteria of his sampling plan. Is this statement true or false? a. True (Go to Frame 3-17.) b. False (Go to Frame 3-18.)
95%	4-19. When the correct table has been selected, locate the line for the actual sample size in the left-hand column. For the problem of Worksheet 4, this is _____.

240

2-12. List the three factors which must be known to determine the proper sample size.

1. _____

2. _____

3. _____

3-17. YOUR ANSWER: a. True

This answer is not correct. If no errors are revealed in the sample, statements can be made with respect to each value of reliability and the corresponding occurrence rate as it appears in the line to the right of the sample size.

Review Frames 3-15 and 3-16 and select a new answer.

460

4-20. Proceed along the line for the sample size until the number of errors found in the sample is reached, or the next higher value. On Table 2-B, the first number in the 460 line equal to, or greater than, 18, the number of errors found in the sample, is _____.

Population size

Maximum tolerable occurrence rate

Specified reliability

/ANY ORDER/

2-13. From a population of 12,000 items, an auditor seeks 99% reliability that compliance deviations do not occur at a rate of 1% or higher. Determine the appropriate sample size. _____

3-18. YOUR ANSWER: b. False

This answer is correct. Separate statements can be made for each level of reliability appearing in the line to the right of the sample size.

Continue with Frame 3-19.

18

4-21. Identify the column in which this number appears. For the problem of Suburban Supply, the value, 18, in the 460 line appears in the column for an upper limit of _____%.

460

(If you had this answer correct, go to Frame 2-21. If not, continue with Frame 2-14.)

2-14. To determine the required sample size, the auditor must first locate the table corresponding to the _____ _____.

3-19. A random sample of 600 items from a population of 8000 revealed no errors. The auditor wants to make separate statements about the maximum true occurrence rate at confidence levels of 90, 95, and 99%. With 99% reliability he can state that the true occurrence rate does not exceed _____%.

6%

(Enter the answer on line 7 of Worksheet 4.)

4-22. The auditor must now make evaluations of the probabilities that his sample would have included at least one critical error if they had occurred at any of the three percentages stated in the problem. Determine these probabilities and enter the results in Lines 8, 9, and 10 of Worksheet 4.

population size	2-15. For a population of 12,000 items, the auditor would select Table _____ in Exhibit I.
0.75%	3-20. However, the value, 90%, and 95% does not appear in the line for a sample size of 600. To determine the maximum true occurrence rate for each of these cases, he should proceed along the line until he reaches the next higher value of reliability and identify the column in which it occurs. For a 90% reliability, the next higher value which appears is _____% and occurs in the column for a true population rate of occurrence of _____%.
8. 5% 9. 37% 10. 90%	4-23. Consider the auditor's statement that he is 5% confident that critical errors do not exceed 0.01%. Which of the following statements is correct? a. He has considerable doubt that the occurrence rate is less than .01%. b. Based upon the sample size used, he has little specific knowledge of the probability that critical errors occurred more or less frequently than .01%.

I-A	2-16. When the correct table has been selected, the auditor must locate the column corresponding to his specified maximum tolerable occurrence rate and proceed down that column until he finds his specified _____ or the next higher value.
92% 0.4%	3-21. Determine the maximum true rate of occurrence in the previous example (no errors in a sample of 600 items drawn from a population of 8,000) for a confidence level of 95%. _____
b. Based upon the sample size used, he has little specific knowledge of the probability that critical errors occurred more or less frequently than .01%.	4-24. In the problem of Suburban Supply, the auditor had no specified reliability at any of the three occurrence rates selected for evaluation. Had there been such a specification, he would have determined the size required for discovery sampling and that required for attribute sampling. His actual sample would have been the (LARGER/SMALLER) of the two.

reliability	2-17. The line in which the specified reliability (or next higher value) occurs is the required sample size. On Table I-A (Page S-22), for a maximum occurrence rate of 1%, a 39% reliability would require a sample size of 50, a 45% reliability would require a sample size of 60, etc. For a reliability of 80%, a sample of _____ items would be required, and a reliability of 95% would require a sample size of _____ items.
0.5%	3-22. In using the tables of Exhibit I for sample evaluation, the following two rules apply. (1) The tables are only applicable if no sample errors are found. (2) All statements of reliability and occurrence rate in the line corresponding to the sample size are valid. If one or more errors are found, the sample should be evaluated with (ATTRIBUTE/DISCOVERY) sampling tables.
LARGER	4-25. What is the appropriate sample size in the following combined problem for a population of 12,000 items? _____

	Critical Errors	Non-Critical Errors
Reliability	95%	90%
Upper Limit	1%	6%
Estimated Error Rate	--	2%

160

300

2-18. An auditor seeks 95% confidence that a population of 15,000 items does not contain more than 1% which are in error. He selects Table I-A in Exhibit I and locates the column corresponding to his maximum tolerable rate of occurrence. Refer to Worksheet 2 (Page S-38) in the Supplementary Section. The column corresponding to the maximum occurrence rate is the column headed _____%.

ATTRIBUTE

3-23. Review Worksheet 1 (Page S-37). In his examination of the vouchers, the auditor finds the following discrepancies. Determine the number of occurrences in the sample and enter your answer on Worksheet 1.

	Amount	Correct Posting	Actual Posting
a.	$ 502.36	General Expense	Administrative Expense
b.	$1,207.42	Advertising Expense	Prepaid Expense

300

(Requirement for discovery sampling, 300, is greater than 90 required for attribute sampling.)

4-26. In cases where the auditor discovers errors in a discovery sampling problem, he (CAN/CANNOT) use discovery sampling tables for evaluation.

1%	2-19. A circle, marked A, has been drawn on Worksheet 2, Sheet 1, to identify the proper column. The auditor proceeds down that column until he reaches the value of the specified reliability or the next (HIGHER/LOWER) value. Draw a circle around this value and label it B.
5. 0 (If you had this answer correct, go to Frame 3-25. If you had any other, continue with Frame 3-24.)	3-24. Since general expenses and administrative expenses would usually be combined on the financial statements of a manufacturing company, a posting error, as in a., would probably have no effect on the statements. The voucher posted to Prepaid Expense rather than Advertising Expense is over $1,000 and therefore not a part of the discovery sample in this case. As the problem states, all disbursement vouchers greater than $1,000 will be examined individually, not sampled.
CANNOT	4-27. When the auditor is unable to evaluate his sample findings with discovery tables due to the existence of errors in his sample, he can determine the upper limit at a given reliability with attribute sampling tables. He selects the table corresponding to his specified _____, enters the line for his actual sample size, locates, on that line, the number of sample errors, and identifies the column in which it appears. This column corresponds to his _____.

HIGHER Your circle, B, should appear as on Worksheet 2, Sheet 2 (Page S-39).	2-20. The line in which the specified reliability occurs determines the required sample size. On Worksheet 2, this would be a sample size of _____.
No answer required	3-25. Since no errors have been found in the sample at Southern Manufacturing, can the auditor make any statement concerning his findings without further analysis? (YES/NO) What statement can the auditor make? _____
reliability maximum occurrence rate (upper limit)	4-28. Review the problem of Worksheet 3 (Page S-40), Modern Producers. From the tables for evaluation of attribute samples, what statement can the auditor make, with his specified 90% reliability, regarding the true occurrence rate of unauthorized employees in his population? _____ _____

300 (See Worksheet 2, Sheet 2, Page S-39.)

2-21. The steps in determination of the correct sample size in discovery sampling can be summarized as follows:

1. Locate the table for the correct _____ _____.
2. Enter the column corresponding to the maximum _____ ____ _____.
3. Proceed down the column until reaching the specified _____ or next higher value.
4. Identify the _____ _____ corresponding to the line in which the reliability appears.

YES

The auditor can state that he is 95% confident that improper postings do not occur in over 0.5% of the vouchers.

3-26. Can the tables in Exhibit I be used for further analysis of his sampling findings? (YES/NO) Why?

_____

_____

_____

He is 90% confident that the true occurrence is less than 2%.

4-29. Which of the following factors is not required for determination of sample size in attribute sampling?

a. population size

b. estimated occurrence rate

c. specified reliability

d. specified maximum occurrence rate

population size

rate of occurrence

reliability

sample size

2-22. On Worksheet 1 (Page S-37), determine the specified reliability and maximum occurrence rate for the sampling problem of the Southern Manufacturing Company. Enter your answers on lines 2 and 3 of the Worksheet.

YES

No errors have been found in the sample. Therefore, the tables are applicable.

3-27. What statement can the auditor make with 99% reliability concerning the posting of disbursement vouchers at Southern Manufacturing Company?

_____

a. population size

4-30. Which of the following factors is not required for determination of sample size in discovery sampling?

a. population size

b. estimated occurrence rate

c. specified reliability

d. specified maximum occurrence rate

2. 95%

3. 0.5%

2-23. What is the required sample size in the problem of the Southern Manufacturing Company? Enter your answer on Line 4 of Worksheet 1.

He can state that the occurrence rate of improper postings does not exceed 0.75%.

3-28. What degree of confidence does the auditor at Southern Manufacturing have that improper postings do not occur in 0.1% of the disbursement vouchers? _____

b. estimated occurrence rate

4-31. To use the discovery sampling tables for sample evaluation, the sample must reveal _____ errors.

4. 600	2-24. From examination of the tables, it is apparent that for any given population size and maximum occurrence rate, the required sample size (INCREASES/DECREASES) as the specified reliability increases.
46%	3-29. Let's briefly examine the significance of the auditor's statement that he is 95% confident that improper postings do not occur in over 0.5% of the vouchers. If errors occurred at the maximum rate, there would have been _____ such occurrences in the population.
0	4-32. If the discovery sample reveals one or more errors, the sample may be evaluated with tables for _____ sampling.

INCREASES

2-25. On Table I-A of Exhibit I (Page S-22), determine the required sample size for the following conditions:

	A	B	C
Max. Occurrence Rate	0.2%	0.3%	0.5%
Reliability	95%	95%	95%
Sample Size	1500	____	____

49

(9800 x .005)

3-30. If each of these 49 occurrences were of the maximum size included in his sampling population and all overstated income before taxes, the maximum overstatement would be $_____.

attribute

THE END

Note: This completes the main portion of the program. However, two appendices are included in the Supplementary Section which teach the auditor how to expand the discovery sampling tables.

B / 1000 C / 600	NOW TURN BACK TO PAGE 3, THE SECOND ROW, AND BEGIN FRAME 2-26.
$49,000	NOW TURN BACK TO PAGE 3, THE THIRD ROW, AND BEGIN FRAME 3-31.