CHAPTER 15

AUDIT SAMPLING FOR TESTS OF CONTROLS AND SUBSTANTIVE TESTS OF TRANSACTIONS

LEARNING OBJECTIVES

After studying this chapter, you should be able to

- **15-1** Explain the concept of representative sampling.
- **15-2** Distinguish between statistical and nonstatistical sampling and between probabilistic and nonprobabilistic sample selection.
- **15-3** Select representative samples.
- **15-4** Define and describe audit sampling for exception rates.
- **15-5** Use nonstatistical sampling in tests of controls and substantive tests of transactions.
- **15-6** Define and describe attributes sampling and a sampling distribution.
- **15-7** Use attributes sampling in tests of controls and substantive tests of transactions.

Sometimes An Isolated Exception Is The Tip Of The Iceberg

David Chen was an experienced assistant on the audit of Sol Systems, a manufacturer of solar panels. While performing tests of controls over sales transactions, he discovered that one of the sales transactions selected for testing was missing shipping information. When asked about the missing documentation, the controller suggested this was an isolated clerical mistake. An hour later, he provided David with the shipping document, which appeared to be valid. Since this was the only one in the sample with a problem, David thought that the results of the test would be considered acceptable under the sampling plan his firm had established, even if the transaction was considered an exception. Still, the transaction was for a fairly large amount, and David was concerned that the documentation was not initially available.

David consulted with Cindy Hubbard, the experienced senior on the engagement. Her initial reaction was to accept the documentation so David could move on to other testing. After considering it for a few minutes, she asked David to look further into the transaction. David discovered that the receivable had not been paid. Instead, a journal entry had been recorded to credit the receivable from the sale. Through a series of journal entries, the receivable ultimately ended up recorded as an asset in a long-term asset account. He examined additional transactions involving this customer and found that they had been handled the same way.

Cindy escalated the findings to the engagement partner. The firm's forensic auditors discovered that Sol was engaged in a large-scale fraud to overstate sales and earnings. The firm resigned from the engagement and reported their findings to the SEC. David was promoted to audit senior a year earlier than normal.

Chapter 14 dealt with designing test of controls and substantive tests of transactions for tests of the sales and collection cycle. Many of these procedures involve the use of sampling. As demonstrated by the story about David Chen and the audit of Sol Systems, appropriately applying audit sampling is a challenging part of the audit. This chapter discusses nonstatistical and statistical sampling for tests of controls and substantive tests of transactions. The discussion is based on the sales and collection cycle, but the sampling concepts apply equally to all other cycles.

The clarified audit standards define **audit sampling** as:

> The selection and evaluation of less than 100 percent of the population of audit relevance such that the auditor expects the items selected to be representative of the population and, thus, likely to provide a reasonable basis for conclusions about the population.

We begin by discussing representative samples and the risks associated with sampling.

REPRESENTATIVE SAMPLES

OBJECTIVE 15-1

Explain the concept of representative sampling.

When selecting a sample from a population, the auditor strives to obtain a representative sample. A **representative sample** is one in which the characteristics in the sample are approximately the same as those of the population. This means that the sampled items are similar to the items not sampled. Assume a client's internal controls require a clerk to attach a shipping document to every duplicate sales invoice, but the clerk fails to follow the procedure exactly 3 percent of the time. If the auditor selects a sample of 100 duplicate sales invoices and finds three are missing attached shipping documents, the sample is highly representative. If two or four such items are found in the sample, the sample is reasonably representative. If no or many missing items are found, the sample is nonrepresentative.

In practice, auditors never know whether a sample is representative, even after all testing is complete. (The only way to know if a sample is representative is to subsequently audit the entire population.) However, auditors can increase the likelihood of a sample being representative by using care in designing the sampling process, sample selection, and evaluation of sample results. A sample result can lead to an incorrect conclusion due to sampling error or nonsampling error. The risk of these two types of errors occurring is called sampling risk and nonsampling risk.

Sampling risk is the risk that an auditor reaches an incorrect conclusion because the sample is not representative of the population. Sampling risk is an inherent part of sampling that results from testing less than the entire population. For example, assume the auditor decided that a control is not effective if there is a population exception rate of 6 percent. Assume the auditor accepts the control as effective based on tests of the control with a sample of 100 items that had two exceptions. If the population actually has an 8 percent exception rate, the auditor incorrectly accepted the population because the sample was not sufficiently representative of the population.

Auditors have two ways to control sampling risk:

1. Adjust sample size
2. Use an appropriate method of selecting sample items from the population

Increasing sample size reduces sampling risk, and vice versa. At one extreme, a sample of all the items of a population has a zero sampling risk. At the other extreme, a sample of one or two items has an extremely high sampling risk.

Using an appropriate sample selection method increases the likelihood of representativeness. This does not eliminate or even reduce sampling risk, but it does allow the auditor to measure the risk associated with a given sample size if statistical methods of sample selection and evaluation are used.

Nonsampling risk is the risk that the auditor reaches an incorrect conclusion for any reason not related to sampling risk. The two causes of nonsampling risk are the auditor's failure to recognize exceptions and inappropriate or ineffective audit procedures.

An auditor might fail to recognize an exception because of exhaustion, boredom, or lack of understanding of what to look for. In the preceding example, assume 3 shipping documents were not attached to duplicate sales invoices in a sample of 100. If the auditor concluded that no exceptions existed, that is a nonsampling error. An ineffective audit procedure for detecting the exceptions in question would be to examine a sample of shipping documents and determine whether each is attached to a duplicate sales invoice, rather than to examine a sample of duplicate sales invoices to determine if shipping documents are attached. In this case, the auditor has done the test in the wrong direction by starting with the shipping document instead of the duplicate sales invoice. Careful design of audit procedures, proper instruction, supervision, and review are ways to control nonsampling risk.

STATISTICAL VERSUS NONSTATISTICAL SAMPLING AND PROBABILISTIC VERSUS NONPROBABILISTIC SAMPLE SELECTION

Before discussing the methods of sample selection to obtain representative samples, it is useful to make distinctions between statistical versus nonstatistical sampling, and probabilistic versus nonprobabilistic sample selection.

Statistical Versus Nonstatistical Sampling

OBJECTIVE 15-2

Distinguish between statistical and nonstatistical sampling and between probabilistic and nonprobabilistic sample selection.

Audit sampling methods can be divided into two broad categories: statistical sampling and nonstatistical sampling. These categories are similar in that they both involve three phases:

1. Plan the sample
2. Select the sample and perform the tests
3 Evaluate the results

The purpose of planning the sample is to make sure that the audit tests are performed in a manner that provides the desired sampling risk and minimizes the likelihood of nonsampling error. Selecting the sample involves deciding how a sample is selected from the population. The auditor can perform the audit tests only after the sample items are selected. Evaluating the results is the drawing of conclusions based on the audit tests.

Assume that an auditor selects a sample of 100 duplicate sales invoices from a population, tests each to determine whether a shipping document is attached, and determines that there are three exceptions. Let's look at those actions step-by-step:

Action	Step
• Decide that a sample size of 100 is needed.	1. Plan the sample
• Decide which 100 items to select from the population. • Perform the audit procedure for each of the 100 items and determine that three exceptions exist.	2. Select the sample Perform the tests
• Reach conclusions about the likely exception rate in the total population when the sample exception rate equals 3 percent.	3. Evaluate the results

Statistical sampling differs from nonstatistical sampling in that, by applying mathematical rules, auditors can quantify (measure) sampling risk in planning the sample (step 1) and in evaluating the results (step 3). (You may remember calculating a statistical result at a 95 percent confidence level in a statistics course. A 95 percent confidence level provides a 5 percent sampling risk.)

In **nonstatistical sampling**, auditors do not quantify sampling risk. However, a properly designed nonstatistical sample that considers the same factors as a properly designed statistical sample can provide results that are as effective as a properly designed statistical sample.

Probabilistic Versus Nonprobabilistic Sample Selection

Both probabilistic and nonprobabilistic sample selection fall under step 2. When using **probabilistic sample selection**, the auditor randomly selects items such that each population item has a known probability of being included in the sample. This process requires great care and uses one of several methods discussed shortly. In **nonprobabilistic sample selection**, the auditor selects sample items using nonprobabilistic methods that approximate a random sampling approach. Auditors can use one of several nonprobabilistic sample selection methods.

Applying Statistical and Nonstatistical Sampling in Practice and Sample Selection Methods

Auditing standards permit auditors to use either statistical or nonstatistical sampling methods. However, it is essential that either method be applied with due care. All steps of the process must be followed carefully. When statistical sampling is used, the sample *must be a probabilistic one* and appropriate statistical evaluation methods must be used with the sample results to make the sampling risk computations. Auditors may make nonstatistical evaluations when using probabilistic selection, but it is never acceptable to evaluate a nonprobabilistic sample using statistical methods.

Probabilistic sample selection methods include the following:

1. Simple random sample selection
2. Systematic sample selection
3. Probability proportional to size sample selection

Nonprobabilistic sample selection methods include:

1. Haphazard sample selection
2. Block sample selection

We will now discuss each of these sample selection methods, starting with probabilistic methods. Auditors often use probabilistic methods even when using nonstatistical sampling.

PROBABILISTIC SAMPLE SELECTION METHODS

OBJECTIVE 15-3

Select representative samples.

Statistical sampling requires a probabilistic sample to measure sampling risk. For probabilistic samples, the auditor uses no judgment about which sample items are selected, except in choosing which of the four selection methods to use.

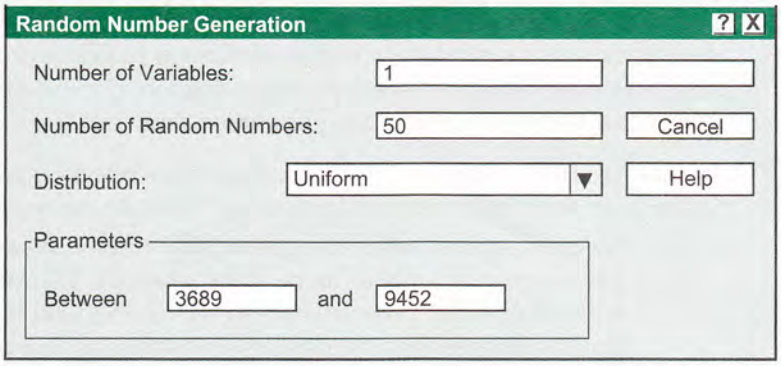
Simple Random Sample Selection

In a simple **random sample**, every possible combination of population items has an equal chance of being included in the sample. Auditors use simple random sampling to sample populations when there is no need to emphasize one or more types of population items. Say, for example, auditors want to sample a client's cash disbursements for the year. They might select a simple random sample of 60 items from the cash disbursements journal, apply appropriate auditing procedures to the 60 items selected, and draw conclusions about all recorded cash disbursement transactions.

When auditors obtain a simple random sample, they must use a method that ensures all items in the population have an equal chance of selection. Suppose an auditor decides to select a sample from a total of 12,000 cash disbursement transactions for the year. A simple random sample of one transaction will be such that each of the 12,000 transactions has an equal chance of being selected. The auditor will select one random number between 1 and 12,000. Assume that number is 3,895. The auditor will select and test only the 3,895th cash disbursement transaction. For a random sample of 100, each population item also has an equal chance of being selected.

Auditors most often generate random numbers by using one of three computer sample selection techniques: electronic spreadsheets, random number generators, and generalized audit software. Figure 15-1 shows the random selection of sales invoices for the audit of Hillsburg Hardware Co. using an electronic spreadsheet

FIGURE 15-1 **Computer Generation of Random Numbers – Hillsburg Hardware Co.**



Random Numbers Selected

5890	4635	5440	5715
4269	4955	9312	8159
7127	3787	8338	4117
8871	5332	9402	4833
8787	5666	5166	4058
9213	6880	9174	5754
3773	5749	3997	6496
6037	5832	7752	6635
8664	5738	8395	5841
4488	8935	9294	9371
5101	6375	6376	3924
3951	6145	5419	5019
3876		8012	

Sorted in Ascending Order

3773	5019	5841	8338
3787	5101	5890	8395
3876	5166	6037	8664
3924	5332	6145	8787
3951	5419	6375	8871
3997	5440	6376	8935
4058	5666	6496	9174
4117	5715	6635	9213
4269	5738	6880	9294
4488	5749	7127	9312
4635	5754	7752	9371
4833	5832	8012	9402
4955		8159	

program. In the example, the auditor wants 50 sample items from a population of sales invoices numbered from 3689 to 9452. The program requires only input parameters to create a sample for the auditor to select. Programs possess great flexibility, are able to generate random dates or ranges of sets of numbers (such as page and line numbers or sales invoice numbers for multiple divisions), and provide output in either sorted or selection order.

Random numbers may be obtained with or without replacement. With replacement means an element in the population can be included in the sample more than once. In selection without replacement, an item can be included only once. Although both selection approaches are consistent with sound statistical theory, auditors rarely use replacement sampling.

Systematic Sample Selection

In **systematic sample selection** (also called systematic sampling), the auditor calculates an interval and then selects the items for the sample based on the size of the interval. The interval is determined by dividing the population size by the desired sample size. In a population of sales invoices ranging from 652 to 3,151, with a desired sample size of 125, the interval is 20 [(3,151 – 651)/125]. The auditor first selects a random number between 0 and 19 (the interval size) to determine the starting point for the sample. If the randomly selected number is 9, the first item in the sample will be invoice number 661 (652 + 9). The remaining 124 items will be 681 (661 + 20), 701 (681 + 20), and so on through item 3,141.

The advantage of systematic selection is its ease of use. In most populations, a systematic sample can be drawn quickly and the approach automatically puts the numbers in sequence, making it easy to develop the appropriate documentation.

A concern with systematic selection is the possibility of bias. Because of the way systematic selection is done, once the first item in the sample is selected, all other

items are chosen automatically. This causes no problem if the characteristic of interest, such as a possible control deviation, is distributed randomly throughout the population, but this may not always be the case. For example, if a control deviation occurred at a certain time of the month or only with certain types of documents, a systematic sample can have a higher likelihood of failing to be representative than a simple random sample. Therefore, when auditors use systematic selection, they must consider possible patterns in the population data that can cause sample bias.

Probability Proportional to Size and Stratified Sample Selection

In many auditing situations, it is advantageous to select samples that emphasize population items with larger recorded amounts. There are two ways to obtain such samples:

1. Take a sample in which the probability of selecting any individual population item is proportional to its recorded amount. This method is called sampling with probability proportional to size (PPS), and it is evaluated using nonstatistical sampling or monetary unit statistical sampling.
2. Divide the population into subpopulations, usually by dollar size, and take larger samples from the subpopulations with larger sizes. This is called stratified sampling, and it is evaluated using nonstatistical sampling or variables statistical sampling.

These selection methods and their related evaluation methods are discussed in more detail in Chapter 17.

NONPROBABILISTIC SAMPLE SELECTION METHODS

Nonprobabilistic sample selection methods are those that do not meet the technical requirements for probabilistic sample selection. Because these methods are not based on mathematical probabilities, the representativeness of the sample may be difficult to determine.

Haphazard Sample Selection

Haphazard sample selection is the selection of items without any conscious bias by the auditor. In such cases, the auditor selects population items without regard to their size, source, or other distinguishing characteristics.

The most serious shortcoming of haphazard sample selection is the difficulty of remaining completely unbiased in the selection. Because of the auditor's training and unintentional bias, certain population items are more likely than others to be included in the sample.

Block Sample Selection

In **block sample selection** auditors select the first item in a block, and the remainder of the block is chosen in sequence. For example, assume the block sample will be a sequence of 100 sales transactions from the sales journal for the third week of March. Auditors can select the total sample of 100 by taking 5 blocks of 20 items, 10 blocks of 10, 50 blocks of 2, or one block of 100.

It is ordinarily acceptable to use block samples only if a reasonable number of blocks is used. If few blocks are used, the probability of obtaining a nonrepresentative sample is too great, considering the possibility of employee turnover, changes in the accounting system, and the seasonal nature of many businesses. For example, in the previous example, sampling 10 blocks of 10 from the third week of March is far less appropriate than selecting 10 blocks of 10 from 10 different months.

Although haphazard and block sample selection appear to be less logical than other sample selection methods, they are often useful in situations where the cost of more complex sample selection methods outweighs the benefits obtained from using these approaches. For example, assume that the auditor wants to trace credits from the accounts receivable master files to the cash receipts journal and other authorized sources as a test for fictitious credits in the master files. In this situation, many auditors use a haphazard or block approach, because it is simpler and much less costly

than other selection methods. However, for many nonstatistical sampling applications involving tests of controls and substantive tests of transactions, auditors prefer to use a probabilistic sample selection method to increase the likelihood of selecting a representative sample.

SAMPLING FOR EXCEPTION RATES

OBJECTIVE 15-4

Define and describe audit sampling for exception rates.

Auditors use sampling for tests of controls and substantive tests of transactions to determine whether controls are operating effectively and whether the rate of monetary errors is below tolerable limits. To do this, auditors estimate the percent of items in a population containing a characteristic or **attribute** of interest. This percent is called the **occurrence rate** or **exception rate**. For example, if an auditor determines that the exception rate for the internal verification of sales invoices is approximately 3 percent, then on average 3 of every 100 invoices are not properly verified.

Auditors are interested in the following types of exceptions in populations of accounting data:

1. Deviations from the client's established controls
2. Monetary misstatements in populations of transaction data
3. Monetary misstatements in populations of account balance details

Knowing the exception rate is particularly helpful for the first two types of exceptions, which involve transactions. Therefore, auditors make extensive use of audit sampling that measures the exception rate in doing tests of controls and substantive tests of transactions. With the third type of exception, auditors usually need to estimate the total dollar amount of the exceptions because they must decide whether the misstatements are material. When auditors want to know the total amount of a misstatement, they use methods that measure dollars, not the exception rate.

The exception rate in a sample is used to estimate the exception rate in the entire population, meaning it is the auditor's "best estimate" of the population exception rate. The term *exception* should be understood to refer to both deviations from the client's control procedures and amounts that are not monetarily correct, whether because of an unintentional accounting error or any other cause. The term *deviation* refers specifically to a departure from prescribed controls.

Assume, for example, that the auditor wants to determine the percentage of duplicate sales invoices that do not have shipping documents attached. Because the auditor cannot check every invoice, the actual percentage of missing shipping documents remains unknown. The auditor obtains a sample of duplicate sales invoices and determines the percentage of the invoices that do not have shipping documents attached. The auditor then concludes that the sample exception rate is the best estimate of the population exception rate.

Because the exception rate is based on a sample, there is a significant likelihood that the sample exception rate differs from the actual population exception rate. This difference is called the *sampling error.* The auditor is concerned with both the estimate of the sampling error and the reliability of that estimate, called *sampling risk.* Assume the auditor determines a 3 percent sample exception rate, and a sampling error of 1 percent, with a sampling risk of 10 percent. The auditor can state that the interval estimate of the population exception rate is between 2 percent and 4 percent (3 percent ± 1) with a 10 percent risk of being wrong (and a 90 percent chance of being right).

In using audit sampling for exception rates, the auditor wants to know the *most* the exception rate is likely to be, rather than the width of the confidence interval. So, the auditor focuses on the upper limit of the interval estimate, which is called the estimated or **computed upper exception rate (CUER)** in tests of controls and substantive tests of transactions. Using figures from the preceding example, an auditor might conclude that the CUER for missing shipping documents is 4 percent

TAX STATS

The Internal Revenue Service (IRS) produces a wealth of information about the financial composition of individuals, business taxpayers, and tax exempt organizations based on samples of tax returns filed with the IRS each year. These reports are issued by the IRS Statistics of Income (SOI) program.

When the IRS receives a submitted tax return, it compiles selected information into a computerized "master file" system, which is the backbone of the agency. As tax returns are processed into the master file system, they are assigned to sampling classes (strata) based on criteria, such as size of income or assets (or other measures of economic size), industrial activity, accounting period, or the presence of certain supplemental forms or schedules.

The SOI program samples tax returns from the master file based on stratified samples of tax returns. Each taxpayer, whether an individual or business, has a unique number (e.g., social security number for individuals or employer identification number for businesses). These unique taxpayer identification numbers are used as the seed for a random number, which along with the sampling strata, determines whether a given return is selected for the SOI sample.

Source: "Tax Stats," *Internal Revenue Service: The Digital Daily* (www.irs.gov).

at a 5 percent sampling risk, meaning the auditor concludes that the exception rate in the population is no greater than 4 percent with a 5 percent risk of the exception rate exceeding 4 percent. Once it is calculated, the auditor can consider CUER in the context of specific audit objectives. If testing for missing shipping documents, for example, the auditor must determine whether a 4 percent exception rate indicates an acceptable control risk for the occurrence objective.

APPLICATION OF NONSTATISTICAL AUDIT SAMPLING

OBJECTIVE 15-5

Use nonstatistical sampling in tests of controls and substantive tests of transactions.

We will now examine the application of nonstatistical audit sampling in testing transactions for control deviations and monetary misstatements. Statistical sampling is examined later in this chapter. Before doing so, key terminology are defined and summarized in Table 15-1. The same terminology is used for statistical sampling.

The auditor first determines whether to apply nonstatistical sampling to those attributes where sampling applies. As previously discussed, there are three phases when sampling for tests of controls and substantive tests of transactions. The auditor must (1) plan the sample; (2) select the sample and perform the audit procedures; and (3) evaluate the results to conclude on the acceptability of the population. These three phases involve 14 well-defined steps. Auditors should follow these steps carefully to ensure proper application of both the auditing and sampling requirements. We use the example audit of Hillsburg Hardware Co. to illustrate the steps in the following discussion.

Plan the Sample

1. State the objectives of the audit test.
2. Decide whether audit sampling applies.
3. Define attributes and exception conditions.
4. Define the population.
5. Define the sampling unit.
6. Specify the tolerable exception rate.
7. Specify acceptable risk of overreliance.
8. Estimate the population exception rate.
9. Determine the initial sample size.

Select the Sample and Perform the Audit Procedures

10. Select the sample.
11. Perform the audit procedures.

Evaluate the Results

12. Generalize from the sample to the population.
13. Analyze exceptions.
14. Decide the acceptability of the population.

TABLE 15-1 Terms Used in Audit Sampling	
TERM	**DEFINITION**
Terms Related to Planning	
Characteristic or attribute	The characteristic being tested in the application
Acceptable risk of overreliance (ARO)	The risk that the auditor is willing to take of accepting a control as effective or a rate of monetary misstatements as tolerable, when the true population exception rate is greater than the tolerable exception rate
Tolerable exception rate (TER)	Exception rate that the auditor will permit in the population and still be willing to conclude the control is operating effectively and/or the amount of monetary misstatements in the transactions established during planning is acceptable
Estimated population exception rate (EPER)	Exception rate that the auditor expects to find in the population before testing begins
Initial sample size	Sample size decided after considering the above factors in planning
Terms Related to Evaluating Results	
Exception	Exception from the attribute in a sample item
Sample exception rate (SER)	Number of exceptions in the sample divided by the sample size
Computed upper exception rate (CUER)	The highest estimated exception rate in the population at a given ARO

State the Objectives of the Audit Test

The objectives of the test must be stated in terms of the transaction cycle being tested. Typically, auditors define the objectives of tests of controls and substantive tests of transactions:

- Test the operating effectiveness of controls
- Determine whether the transactions contain monetary misstatements

The objectives of these tests in the sales and collection cycle are usually to test the effectiveness of internal controls over sales and cash receipts and to determine whether sales and cash receipts transactions contain monetary misstatements. Auditors normally define these objectives as a part of designing the audit program, which was discussed for the sales and collection cycle in Chapter 14. You can find the audit program for the sales and collection cycle for Hillsburg Hardware in Figure 14-6 (p. 480).

Decide Whether Audit Sampling Applies

Audit sampling applies whenever the auditor plans to reach conclusions about a population based on a sample. The auditor should examine the audit program and select those audit procedures where audit sampling applies. To illustrate, assume the following partial audit program:

1. Review sales transactions for large and unusual amounts (analytical procedure).
2. Observe whether the duties of the accounts receivable clerk are separate from handling cash (test of control).
3. Examine a sample of duplicate sales invoices for
   a. credit approval by the credit manager (test of control).
   b. existence of an attached shipping document (test of control).
   c. inclusion of a chart of accounts number (test of control).
4. Select a sample of shipping documents and trace each to related duplicate sales invoices (test of control).
5. Compare the quantity on each duplicate sales invoice with the quantity on related shipping documents (substantive test of transactions).

Audit sampling does not apply for the first two procedures in this audit program. The first is an analytical procedure for which sampling is inappropriate. The second is an observation procedure for which no documentation exists to perform audit

TABLE 15-2 Audit Procedures – Hillsburg Hardware Co.

PROCEDURE	COMMENT
Shipment of Goods	
10. Account for a sequence of shipping documents.	It is possible to do this by selecting a random sample and accounting for all shipping documents selected. This requires a separate set of random numbers because the sampling unit is different from that used for the other tests.
11. Trace selected shipping documents to the sales journal to be sure that each one has been included.	No exceptions are expected, and a 6 percent TER is considered acceptable at an ARO of 10 percent. A sample size of 40 is selected. The shipping documents are traced to the sales journal. This is done for all 40 items. There are no exceptions for either test. The results are considered acceptable. There is no further information about this portion of the tests in this illustration.
Billing of Customers and Recording the Sales in the Records	
12. Account for a sequence of sales invoices in the sales journal.	The audit procedures for billing and recording sales (procedures 12 to 14) are the only ones included for illustration throughout this chapter.
13. Trace selected sales invoice numbers from the sales journal to a. accounts receivable master file and test for amount, date, and invoice number. b. duplicate sales invoice and check for the total amount recorded in the journal, date, customer name, and account classification. Check the pricing, extensions, and footings. Examine underlying documents for indication of internal verification. c. bill of lading and test for customer name, product description, quantity, and date. d. duplicate sales order and test for customer name, product description, quantity, date, and indication of internal verification. e. customer order and test for customer name, product description, quantity, date, and credit approval.	
14. Trace recorded sales from the sales journal to the file of supporting documents, which includes a duplicate sales invoice, bill of lading, sales order, and customer order.	

Note: Random selection and statistical sampling are not applicable for the nine general audit procedures in Figure 14-6 (p. 480). Advanced statistical techniques, such as regression analysis, can be applicable for analysis of the results of analytical procedures. Except for audit procedure 18, random selection may be possible for cash receipt procedures 15 through 21. Random selection can also be used for procedure 2.

sampling. Audit sampling can be used for the remaining three procedures. Audit sampling generally applies to manual controls. Automated controls can be tested using the computer assisted auditing techniques described in Chapter 12. Table 15-2 indicates the audit procedures for the sales cycle for Hillsburg Hardware Co. where audit sampling is appropriate.

Define Attributes and Exception Conditions

When audit sampling is used, auditors must carefully define the characteristics (attributes) being tested and the exception conditions. Unless they carefully define each attribute in advance, the staff person who performs the audit procedures will have no guidelines to identify exceptions.

Attributes of interest and exception conditions for audit sampling are taken directly from the auditor's audit procedures. Table 15-3 shows nine attributes of interest and exception conditions taken from audit procedures 12 through 14 in the audit of Hillsburg's billing function. Samples of sales invoices will be used to verify these attributes. The absence of the attribute for any sample item will be an exception

TABLE 15-3 Attributes Defined—Tests of Hillsburg Hardware Co.'s Billing Function

Attribute	Exception Condition
1. Existence of the sales invoice number in the sales journal (procedure 12).	No record of sales invoice number in the sales journal.
2. Amount and other data in the master file agree with sales journal entry (procedure 13a).	The amount recorded in the master file differs from the amount recorded in the sales journal.
3. Amount and other data on the duplicate sales invoice agree with the sales journal entry (procedure 13b).	Customer name and account number on the invoice differ from the information recorded in the sales journal.
4. Evidence that pricing, extensions, and footings are checked (initials and correct amounts) (procedure 13b).	Lack of initials indicating verification of pricing, extensions, and footings.
5. Quantity and other data on the bill of lading agree with the duplicate sales invoice and sales journal (procedure 13c).	Quantity of goods shipped differs from quantity on the duplicate sales invoice.
6. Quantity and other data on the sales order agree with the duplicate sales invoice (procedure 13d).	Quantity on the sales order differs from the quantity on the duplicate sales invoice.
7. Quantity and other data on the customer order agree with the duplicate sales invoice (procedure 13e).	Product number and description on the customer order differ from information on the duplicate sales invoice.
8. Credit is approved (procedure 13e).	Lack of initials indicating credit approval.
9. For recorded sales in the sales journal, the file of supporting documents includes a duplicate sales invoice, bill of lading, sales order, and customer order (procedure 14).	Bill of lading is not attached to the duplicate sales invoice and the customer order.

for that attribute. Both missing documents and immaterial misstatements result in exceptions unless the auditor specifically states otherwise in the exception conditions.

Define the Population

The population is those items about which the auditor wishes to generalize. Auditors can define the population to include any items they want, but when they select the sample, it must be selected from the entire population as it has been defined. The auditor should test the population for completeness and detail tie-in before a sample is selected to ensure that all population items are subjected to sample selection.

The auditor may generalize *only* about that population that has been sampled. For example, when performing tests of controls and substantive tests of sales transactions, the auditor generally defines the population as all recorded sales invoices for the year. If the auditor samples from only one month's transactions, it is invalid to draw conclusions about the invoices for the entire year.

The auditor must carefully define the population in advance, consistent with the objectives of the audit tests. In some cases, it may be necessary to define separate populations for different audit procedures. For example, in the audit of the sales and collection cycle for Hillsburg Hardware Co., the direction of testing in audit procedures 12 through 14 (in Table 15-2) proceeds from sales invoices in the sales journal to source documentation. In contrast, the direction of testing for audit procedures 10 and 11 proceeds from the shipping documents to the sales journal. Thus, the auditor defines two populations—a population of sales invoices in the sales journal and a population of shipping documents.

Define the Sampling Unit

The sampling unit is defined by the auditor based on the definition of the population and objective of the audit test. The sampling unit is the physical unit that corresponds to the random numbers the auditor generates. It is often helpful to think of the sampling unit as the starting point for doing the audit tests. For the sales and collection cycle, the sampling unit is typically a sales invoice or shipping document number. For example, if the auditor wants to test the occurrence of sales, the appropriate sampling unit is sales invoices recorded in the sales journal. If the objective is to determine whether the quantity of the goods described on the customer's order is accurately shipped and billed, the auditor can define the sampling unit as the customer's order, the shipping document, or the duplicate sales invoice, because the direction of the audit test doesn't matter for this audit procedure.

Audit procedure 14 in Table 15-2 (p. 504) is a test for the occurrence of recorded sales. What is the appropriate sampling unit? It is the duplicate sales invoice. Is the appropriate sampling unit for audit procedure 11 the shipping document? Yes, because this tests that existing sales are recorded (completeness). Either the duplicate sales invoice or the shipping document is appropriate for audit procedures 13a through 13e because these are all nondirectional tests.

To perform audit procedures 12 through 14, the auditor will define the sampling unit as the duplicate sales invoice. Audit procedures 10 and 11 will have to be tested separately using a sample of shipping documents.

Specify the Tolerable Exception Rate

Establishing the **tolerable exception rate (TER)** for each attribute requires an auditor's professional judgment. TER represents the highest exception rate the auditor will permit in the control being tested and still be willing to conclude the control is operating effectively (and/or the rate of monetary misstatements in the transactions is acceptable). For example, assume that the auditor decides that TER for attribute 8 in Table 15-3 (p. 505) is 9 percent. That means that the auditor has decided that even if 9 percent of the duplicate sales invoices are not approved for credit, the credit approval control is still effective in terms of the assessed control risk included in the audit plan.

When determining TER, the auditor considers the degree of reliance to be placed on the control and the significance of the control to the audit. If only one internal control is used to support a low control risk assessment for an objective, TER will be lower for the attribute than if multiple controls are used to support a low control risk assessment for the same objective. Control deviations increase the risk of material misstatements in the accounting records, but do not necessarily result in misstatements. For example, a disbursement that does not have evidence of proper approval may have been properly authorized and recorded. For this reason, the tolerable rate of deviation for tests of controls is normally higher than the comparable tolerable rate of exception for monetary misstatements.

TER can have a significant impact on sample size. A larger sample size is needed for a low TER than for a high TER. For example, a larger sample size is needed for the test of credit approval (attribute 8) if the TER is decreased from 9 percent to 6 percent. Since a lower TER is used for significant account balances, the auditor requires a larger sample size to gather sufficient evidence about the effectiveness of the control or absence of monetary misstatements.

Most auditors use some type of template to document each sampling application. Figure 15-2 shows one example of a commonly used form. Notice that the top part of the form includes a definition of the objective, the population, and the sampling unit.

Auditors determine the TER for each attribute being tested in audit procedures 12 through 14 in Table 15-3 by deciding what exception rate is material. As Figure 15-2, indicates:

- For attribute 1, the failure to record a sales invoice would be highly significant, so the lowest TER (4 percent) is chosen.

FIGURE 15-2 **Sampling Data Sheet: Tests of Hillsburg Hardware Co.'s Billing Function**

Client: Hillsburg Hardware
Audit Area: Tests of Controls and Substantive Tests of Transactions—Billing Function

Year-end: 12/31/13
Pop. size: 5,764

Define the objective(s): Examine duplicate sales invoices and related documents to determine whether the system has functioned as intended and as described in the audit program.

Define the population precisely (including stratification, if any): Sales invoices for the period 1/1/13 to 10/31/13. First invoice number = 3689. Last invoice number = 9452.

Define the sampling unit, organization of population items, and random selection procedures: Sales invoice number, recorded in the sales journal sequentially; computer generation of random numbers.

	Planned Audit				Actual Results			
Description of Attributes	**EPER**	**TER**	**ARO**	**Initial sample size**	**Sample size**	**Number of exceptions**	**Sample exception rate**	**Calculated Sampling Error (TER − SER)**
1. Existence of the sales invoice number in the sales journal (procedure 12).	0	4	Low	75				
2. Amount and other data in the master file agree with sales journal entry (procedure 13a).	1	5	Low	100				
3. Amount and other data on the duplicate sales invoice agree with the sales journal entry (procedure 13b).	1	5	Low	100				
4. Evidence that pricing, extensions, and footings are checked (initials and correct amounts) (procedure 13b).	1	5	Low	100				
5. Quantity and other data on the bill of lading agree with the duplicate sales invoice and sales journal (procedure 13c).	1	5	Low	100				
6. Quantity and other data on the sales order agree with the duplicate sales invoice (procedure 13d).	1	7	Low	65				
7. Quantity and other data on the customer order agree with the duplicate sales invoice (procedure 13e).	1.5	9	Low	50				
8. Credit is approved (procedure 13e).	1.5	9	Low	50				
9. For recorded sales in the sales journal, the file of supporting documents includes a duplicate sales invoice, bill of lading, sales order, and customer order (procedure 14).	1	7	Low	65				

Intended use of sampling results:

1. Effect on Audit Plan:

2. Recommendations to Management:

- For attributes 2-5, the incorrect billing to a customer and recording the transaction is potentially significant, but no misstatement is likely to be for the full amount of the invoice. As a result, the auditor chose a 5 percent TER for each of these attributes.
- Attributes 6-9 have higher TERs because they are of less importance in the audit.

Specify Acceptable Risk of Overreliance

Whenever auditors take a sample, they risk making incorrect conclusions about the population. The risk that the auditor concludes that controls are more effective than they actually are is the risk of overreliance. The risk of underreliance is the risk that the auditor will erroneously conclude that the controls are less effective than they actually are. Underreliance affects the efficiency of the audit. The incorrect

conclusion that a control is ineffective may lead to an unnecessary increase in assessed control risk and substantive tests. In contrast, overreliance on a control impacts the effectiveness of the audit, because reliance on an ineffective control leads to an inappropriate reduction in substantive tests.

Auditors are normally more concerned with the risk of overreliance because it impacts the effectiveness of the audit. The **acceptable risk of overreliance (ARO)** measures the risk the auditor is willing to take of accepting a control as effective (or a rate of misstatements as tolerable) when the true population exception rate is greater than TER.

ARO represents the auditor's measure of sampling risk. Assume that TER is 6 percent, ARO is high, and the true population exception rate is 8 percent. The control in this case is not acceptable because the true exception rate of 8 percent exceeds TER. The auditor, of course, does not know the true population exception rate. The ARO of high means that the auditor is willing to take a fairly substantial risk of concluding that the control is effective after all testing is completed, even when it is ineffective. If the control were found to be effective in this illustration, the auditor would have overrelied on the system of internal control (used a lower assessed control risk than was justified).

In choosing the appropriate ARO for each attribute, auditors must use their best judgment. Their main consideration is the extent to which they plan to reduce assessed control risk as a basis for the extent of tests of details of balances. Auditors normally assess ARO at a lower level when auditing an accelerated filer public company because the auditor needs greater assurance that the internal controls are effective to support the opinion on internal control over financial reporting. In audits of non-accelerated filers and private companies, the appropriate ARO and extent of tests of controls depend on assessed control risk. For audits where there is extensive reliance on internal control, control risk will be assessed at low and therefore ARO will also be as low. Conversely, if the auditor plans to rely on internal controls only to a limited extent, control risk will be assessed as high and so will ARO.

For nonstatistical sampling, it is common for auditors to use ARO of high, medium, or low instead of a percentage. For statistical sampling it is common for auditors to use a percent, such as 5% or 10%. A low ARO implies that the tests of controls are important and will correspond to a low assessed control risk and reduced substantive tests of details of balances. As summarized in Figure 15-2 (p. 507), ARO for the audit of the billing function at Hillsburg Hardware Co. is assessed as low for all attributes, because it is an accelerated filer public company and the auditor's tests of controls must provide a basis for the opinion on internal control over financial

TABLE 15-4 Guidelines for ARO and TER for Nonstatistical Sampling: Tests of Controls

Planned Reduction in Substantive Tests of Details of Balances	Judgment	Guideline
Assessed control risk. Consider: Need to issue a separate report on internal control over financial reporting for accelerated filer public companies Nature, extent, and timing of substantive tests (extensive planned substantive tests relate to higher assessed control risk and vice versa) Quality of evidence available for tests of controls (a lower quality of evidence available results in a higher assessed control risk and vice versa)	• Lowest assessed control risk • Moderate assessed control risk • Higher assessed control risk • 100% assessed control risk	• ARO of low • ARO of medium • ARO of high • ARO is not applicable
Significance of the transactions and related account balances that the internal controls are intended to affect	• Highly significant balances • Significant balances • Less significant balances	• TER of 4% • TER of 5% • TER of 6%

Note: The guidelines should recognize that there may be variations in AROs based on audit considerations. The guidelines above are the most conservative that should be followed.

TABLE 15-5 Guidelines for ARO and TER for Nonstatistical Sampling: Substantive Tests of Transactions

Planned Reduction in Substantive Tests of Details of Balances	Results of Understanding Internal Control and Tests of Controls	ARO for Substantive Tests of Transactions	TER for Substantive Tests of Transactions
Large	Excellent[1] Good Not good	High Medium Low	Percent or amount based on materiality considerations for related accounts
Moderate	Excellent[1] Good Not good	High Medium Medium-low	Percent or amount based on materiality considerations for related accounts
Small[2]	Excellent[1] Good Not good	High Medium-high Medium	Percent or amount based on materiality considerations for related accounts

Note: The guidelines should also recognize that there may be variations in AROs based on audit considerations. The guidelines above are the most conservative that should be followed.
[1]In this situation, both internal control and evidence about it are good. Substantive tests of transactions are least likely to be performed in this situation.
[2]In this situation, little emphasis is being placed on internal controls. Neither tests of controls nor substantive tests of transactions are likely in this situation.

reporting. As a result, the auditor requires a low risk of overrelying on controls. Stated another way, the auditor needs greater assurance and therefore a larger sample size to support the lower risk of overreliance.

Like for TER, there is an inverse relationship between ARO and planned sample size. If the auditor reduces ARO from high to low, planned sample size must be increased. ARO represents the auditor's risk of incorrectly accepting the control as effective, and a larger sample size is required to lower this risk.

The auditor can establish different TER and ARO levels for different attributes of an audit test, depending on the importance of the attribute and related control. For example, auditors commonly use higher TER and ARO levels for tests of credit approval than for tests of the occurrence of duplicate sales invoices and bills of lading. This makes sense because the exceptions for the latter are likely to have a more direct impact on the correctness of the financial statements than the former.

Tables 15-4 and 15-5 present illustrative guidelines for establishing TER and ARO. The guidelines should not be interpreted as representing broad professional standards. However, they are typical of the types of guidelines CPA firms issue to their staff.

Estimate the Population Exception Rate

Auditors should make an advance estimate of the population exception rate to plan the appropriate sample size. If the **estimated population exception rate (EPER)** is low, a relatively small sample size will satisfy the auditor's tolerable exception rate, because a less precise estimate is required.

Auditors often use the preceding year's audit results to estimate EPER. If prior-year results are not available, or if they are considered unreliable, the auditor can take a small preliminary sample of the current year's population for this purpose. It is not critical that the estimate be precise because the current year's sample exception rate is ultimately used to estimate the population characteristics. If a preliminary sample is used, it can be included in the total sample, as long as appropriate sample selection procedures are followed. In the Hillsburg Hardware Co. audit, the estimated population exception rates for the attributes in Figure 15-2 are based on the previous year's results, modified slightly to account for the change in personnel.

Determine the Initial Sample Size

Four factors determine the **initial sample size** for audit sampling: population size, TER, ARO, and EPER. Population size is not a significant factor and typically can be ignored, especially for large populations. Auditors using nonstatistical sampling

TABLE 15-6	Effect on Sample Size of Changing Factors
Type of Change	**Effect on Initial Sample Size**
Increase acceptable risk of overreliance	Decrease
Increase tolerable exception rate	Decrease
Increase estimated population exception rate	Increase
Increase population size	Increase (minor effect)

decide the sample size using professional judgment rather than using a statistical formula. Once the three major factors affecting sample size have been determined, the auditor can decide an initial sample size. It is called an initial sample size because the exceptions in the actual sample must be evaluated before auditors can decide whether the sample is sufficiently large to achieve the objectives of the tests.

Sensitivity of Sample Size to a Change in the Factors To understand the concepts underlying sampling in auditing, you need to understand the effect of increasing or decreasing any of the four factors that determine sample size, while the other factors are held constant. Table 15-6 shows the effect on sample size of independently increasing each factor. The opposite effect will occur for decreasing each factor.

A combination of two factors has the greatest effect on sample size: TER minus EPER. The difference between the two factors is the *precision* of the initial sample estimate. A smaller precision, which is called a more precise estimate, requires a larger sample. At one extreme, assume TER is 4% and EPER is 3%. In this case, precision is 1%, which will result in a large sample size. Now assume TER is 8% and EPER is zero for an 8% precision. In this case the sample size can be small and still give the auditor confidence that the actual exception rate is less than 8%, assuming no exceptions are found when auditing the sample.

Figure 15-2 (p. 507) summarizes the different sample sizes selected for testing attributes 1 through 9 for the Hillsburg audit. The largest sample (a size of 100) is selected for tests of attributes 2 through 5, because of the degree of precision required. For those attributes, the difference between TER and EPER is smallest, thus requiring a larger sample size than attributes 6 through 9. Although the difference between TER and EPER for attribute 1 is the same as that for attributes 2 through 5, the estimated population exception rate of zero justifies a smaller sample of 75 items.

SAMPLE SIZES FOR SMALL POPULATIONS AND INFREQUENTLY OPERATING CONTROLS

Many important controls, such as controls over the year-end closing process, may be performed only once a year. Other controls, such as reconciliations and exception reports, may operate on a weekly or monthly basis. The AICPA *Audit Sampling* Audit Guide provides guidance for testing the operating effectiveness of small populations.

Control Frequency and Population Size	Items to Test
Quarterly (4)	2
Monthly (12)	2–4
Semimonthly (24)	3–8
Weekly (52)	5–9

Sample sizes near the low end of the range are appropriate for control reliance in normal financial statement audit situations. Sample sizes near or above the upper range are appropriate where other sources of evidence are less persuasive, where there are concerns about the operations of the control, when controls have changed, or where deficiencies have been experienced in the past. Auditors can use sampling parameters such as risk and the tolerable exception rate to determine sample sizes when the test is the sole source of evidence about the effectiveness of the control and a high level of audit evidence is desired.

Source: Based on *Audit Sampling* Audit Guide, American Institute of Certified Public Accountants, 2012.

FIGURE 15-3 **Inspection of Sample Items for Attributes**

CLIENT: Hillsburg Hardware
INSPECTION OF SAMPLE ITEMS
FOR ATTRIBUTES
YEAR-END: DECEMBER 31, 2013

Prepared by MSW
Date 11/15/13

Identity of Item Selected	Attributes X = Exception											
Invoice no.	1	2	3	4	5	6	7	8	9	10	11	
3787					X							
3924				X								
3990				X								
4058		X		X								
4117								X				
4222					X							
4488								X				
4635				X	X							
4955						X						
4969				X								
5101								X				
5166								X				
5419								X				
5832								X				
5890								X				
6157		X		X								
6229				X								
6376								X				
6635					X							
7127				X								
8338								X				
8871				X								
9174								X				
9371				X								
No. Exceptions	0	2	0	10	4	1	0	10	0			
Sample Size	75	100	100	100	100	65	50	50	65			

Because a less precise estimate is needed (TER minus EPER is larger) for attributes 7 and 8, a sample size of only 50 items is needed.

Select the Sample

After auditors determine the initial sample size for the audit sampling application, they must choose the items in the population to include in the sample. Auditors can choose the sample using any of the probabilistic or nonprobabilistic methods we discussed earlier in this chapter. To minimize the possibility of the client altering the sample items, the auditor should not inform the client too far in advance of the sample items selected. The auditor should also control the sample after the client provides the documents. Several additional sample items may be selected as extras to replace any voided items in the original sample.

The random selection for the Hillsburg audit procedures is straightforward except for the different sample sizes needed for different attributes. To overcome this problem, auditors can select a random sample of 50 for use on all nine attributes, followed by another sample of 15 for all attributes except attributes 7 and 8, an additional 10 for attributes 1 through 5, and 25 more for attributes 2 through 5.

Figure 15-1 (p. 499) illustrates the selection of the first 50 sample items for Hillsburg Hardware using computer generation of random numbers.

Perform the Audit Procedures

The auditor performs the audit procedures by examining each item in the sample to determine whether it is consistent with the definition of the attribute and by maintaining a record of all the exceptions found. When audit procedures have been completed for a sampling application, the auditor will have a sample size and number of exceptions for each attribute.

To document the tests and provide information for review, auditors commonly include a schedule of the results. Some auditors prefer to include a schedule listing all items in the sample; others prefer to limit the documentation to identifying the exceptions. This latter approach is followed in Figure 15-3 (p. 511).

Generalize from the Sample to the Population

The **sample exception rate (SER)** can be easily calculated from the actual sample results. SER equals the actual number of exceptions divided by the actual sample size. Figure 15-3 summarizes the exceptions found for tests of attributes 1 through 9. In this example, the auditor found zero exceptions for attribute 1 and two exceptions for attribute 2, making the SER 0 percent (0 ÷ 75) for attribute 1, and 2 percent for attribute 2 (2 ÷100).

When evaluating a sample for tests of controls and substantive tests of transactions, the auditor should evaluate sampling risk. When nonstatistical sampling is used, sampling risk cannot be directly measured. One way to evaluate sampling risk is to subtract the sample exception rate from the tolerable exception rate to find the calculated sampling error (TER – SER), and evaluate whether it is sufficiently large to conclude that the true population exception rate is acceptable. For example, if an auditor takes a sample of 100 items for an attribute and finds no exceptions (SER = 0) and TER is 5 percent, calculated sampling error is 5 percent (TER of 5 percent – SER of 0 = 5 percent). If the auditors had found four exceptions, calculated sampling error would have been 1 percent (TER of 5 percent – SER of 4 percent). It is much more likely that the true population exception rate is less than or equal to the tolerable exception rate in the first case than in the second one. Therefore, most auditors would probably find the population acceptable based on the first sample result and not acceptable based on the second.

When SER exceeds the EPER used in designing the sample, auditors usually conclude that the sample results do not support the preliminary assessed control risk. In that case, auditors are likely to conclude that there is an unacceptably high risk that the true deviation rate in the population exceeds TER.

The auditor's consideration of whether sampling error is sufficiently large also depends on the sample size used. If the sample size in the previous example had been only 20 items, the auditor would have been much less confident that finding no exceptions was an indication that the true population exception rate does not exceed TER.

The SER and the calculated sampling error (TER – SER) for Hillsburg Hardware are summarized in Figure 15-4.

Analyze Exceptions

In addition to determining SER for each attribute and evaluating whether the true (but unknown) exception rate is likely to exceed the tolerable exception rate, auditors must analyze individual exceptions to determine the breakdown in the internal controls that allowed them to happen. Exceptions can be caused by many factors, such as carelessness of employees, misunderstood instructions, or intentional failure

FIGURE 15-4 **Sampling Data Sheet: Tests of Hillsburg Hardware Co.'s Billing Function**

Client: Hillsburg Hardware
Audit Area: Tests of Controls and Substantive Tests of Transactions—Billing Function

Year-end: 12/31/13
Pop. size: 5,764

Define the objective(s): Examine duplicate sales invoices and related documents to determine whether the system has functioned as intended and as described in the audit program.

Define the population precisely (including stratification, if any): Sales invoices for the period 1/1/13 to 10/31/13. First invoice number = 3689. Last invoice number = 9452.

Define the sampling unit, organization of population items, and random selection procedures: Sales invoice number, recorded in the sales journal sequentially; computer generation of random numbers.

	Planned Audit				Actual Results			
Description of Attributes	**EPER**	**TER**	**ARO**	**Initial sample size**	**Sample size**	**Number of exceptions**	**Sample exception rate**	**Calculated Sampling Error (TER – SER)**
1. Existence of the sales invoice number in the sales journal (procedure 12).	0	4	Low	75	75	0	0	4.0
2. Amount and other data in the master file agree with sales journal entry (procedure 13a).	1	5	Low	100	100	2	2	3.0
3. Amount and other data on the duplicate sales invoice agree with the sales journal entry (procedure 13b).	1	5	Low	100	100	0	0	5.0
4. Evidence that pricing, extensions, and footings are checked (initials and correct amounts) (procedure 13b).	1	5	Low	100	100	10	10	SER exceeds TER
5. Quantity and other data on the bill of lading agree with the duplicate sales invoice and sales journal (procedure 13c).	1	5	Low	100	100	4	4	1.0
6. Quantity and other data on the sales order agree with the duplicate sales invoice (procedure 13d).	1	7	Low	65	65	1	1.5	5.5
7. Quantity and other data on the customer order agree with the duplicate sales invoice (procedure 13e).	1.5	9	Low	50	50	0	0	9.0
8. Credit is approved (procedure 13e).	1.5	9	Low	50	50	10	20	SER exceeds TER
9. For recorded sales in the sales journal, the file of supporting documents includes a duplicate sales invoice, bill of lading, sales order, and customer order (procedure 14).	1	7	Low	65	65	0	0	7.0

Intended use of sampling results:

1. Effect on Audit Plan: Controls tested through attributes 1, 3, 6, 7, and 9 can be viewed as operating effectively given the size of the allowance for sampling error (e.g., TER – SER). Additional emphasis is needed in confirmation, allowance for uncollectible accounts, cutoff tests, and price tests for the financial statement audit due to results of tests for attributes 2, 4, 5, and 8.

2. Effect on Report on Internal Control: The allowance for sampling error is too small or SER exceeds TER for attributes 2, 4, 5, and 8. These findings have been communicated to management to allow an opportunity for correction of the control deficiency to be made before year-end. If timely correction is made by management, the corrected controls will be tested before year-end for purposes of reporting on internal control over financial reporting.

3. Recommendations to Management: Each of the exceptions should be discussed with management. Specific recommendations are needed to correct the internal verification of sales invoices and to improve the approach to credit approvals.

to perform procedures. The nature of an exception and its causes have a significant effect on the qualitative evaluation of the system. For example, if all the exceptions in the tests of internal verification of sales invoices occurred while the person normally

responsible for performing the tests was on vacation, this would affect the auditor's evaluation of the internal controls and the subsequent investigation differently than if the exceptions arose from the incompetence of the regular employee.

The exception analysis is illustrated for Hillsburg in Figure 15-5.

Decide the Acceptability of the Population

When generalizing from the sample to the population, most auditors using non-statistical sampling subtract SER from TER and evaluate whether the difference (calculated sampling error) is sufficiently large. If the auditor concludes the difference is sufficiently large, the control being tested can be used to reduce assessed control risk as planned, assuming a careful analysis of the exceptions does not indicate the possibility of other significant problems with internal controls.

As Figure 15-4 (p. 513) illustrates, SER exceeds TER for attributes 4 and 8. Although SER is less than TER for attributes 2 and 5, the auditor concluded that the calculated allowance for sampling error is too small and the results of these tests are therefore also unacceptable.

When the auditor determines that TER – SER is too small to conclude that the population is acceptable, or when SER exceeds TER, the auditor must follow one of four courses of action:

Revise TER or ARO This alternative should be followed only when the auditor has concluded that the original specifications were too conservative. Relaxing either TER or ARO may be difficult to defend if the auditor is ever subject to review by a court or a commission. Auditors should change these requirements only after careful consideration.

Expand the Sample Size An increase in the sample size has the effect of decreasing the sampling error if the actual sample exception rate does not increase. Of course, SER may also increase or decrease if additional items are selected. Increasing the sample size is appropriate if the auditor believes the initial sample was not representative, or if it is important to obtain evidence that the control is operating effectively. This is likely if the auditor is reporting on internal control, or if the control relates to highly significant account balances such as receivables or inventory.

Revise Assessed Control Risk If the results of the tests of controls and substantive tests of transactions do not support the preliminary assessed control risk, the auditor should revise assessed control risk upward. This will likely result in the auditor increasing substantive tests of transactions and tests of details of balances. For example, if tests of controls of internal verification procedures for verifying prices, extensions, and quantities on sales invoices indicate that those procedures are not being followed, the auditor should increase substantive tests of transactions for the accuracy of sales. If the substantive tests of transactions results are unacceptable, the auditor must increase tests of details of balances for accounts receivable.

The auditor should decide whether to increase sample size or to revise assessed control risk on the basis of cost versus benefit. If the sample is not expanded, the auditor must revise assessed control risk upward and therefore perform additional substantive tests. The cost of additional tests of controls must be compared with that of additional substantive tests. If an expanded sample continues to produce unacceptable results, additional substantive tests will still be necessary.

For accelerated filer public companies, the auditor must evaluate the control deficiencies to determine their effect on the auditor's report on internal control. If the deficiencies constitute a material weakness but are corrected before year-end, the auditor may be able to test management's corrected controls. The auditor may also be able to identify additional compensating controls. If the auditor is unable to test corrected controls or identify compensating controls and the deficiencies are deemed to be material weaknesses, the audit report on internal control must be an adverse opinion.

Communicate with the Audit Committee or Management Communication is desirable, in combination with one of the other three actions just described, regardless

FIGURE 15-5 **Analysis of Exceptions**

CLIENT: Hillsburg Hardware
ANALYSIS OF EXCEPTIONS **Prepared by:** MSW
YEAR-END: December 31, 2013 **Date:** 11/15/13

Attribute	Number of exceptions	Nature of exceptions	Effect on the financial statement audit and other comments*
2	2	Both errors were posted to the wrong account and were still outstanding after several months. The amounts were for $2,500 and $7,900.	Because the allowance for sampling error is small (e.g., TER – SER), additional substantive work is needed. Perform expanded confirmation procedures and review older uncollected balances thoroughly.
4	10	–In six cases there were no initials for internal verification. –In two cases the wrong price was used but the errors were under $200 in each case. –In one case there was a pricing error of $5,000. –In one case freight was not charged. (Three of the last four exceptions had initials for internal verification.)	As a result, have independent client personnel recheck a random sample of 500 duplicate sales invoices under our control. Also, expand the confirmation of accounts receivable.
5	4	In each case the date on the duplicate sales invoice was several days later than the shipping date.	Do extensive tests of the sales cutoff by comparing recorded sales with the shipping documents.
6	1	Just 106 items were shipped and billed though the sales order was for 112 items. The reason for the difference was an error in the perpetual inventory master file. The perpetuals indicated that 112 items were on hand, when there were actually 106. The system does not backorder for undershipments smaller than 25%.	No expansion of tests of controls or substantive tests. The system appears to be working effectively.
8	10	Credit was not approved. Four of these were for new customers. Discussed with Chulick, who stated his busy schedule did not permit approving all sales.	Expand the year-end procedures extensively in evaluating allowance for uncollectible accounts. This includes scheduling of cash receipts subsequent to year-end for all outstanding accounts receivable to determine collectibility at year-end.

*This column documents conclusions about implications for the financial statement audit. The control deficiencies have been communicated to management to allow an opportunity for correction of the deficiency before year-end. If timely correction is made by management, the corrected controls will be tested before year-end for purposes of reporting on internal control over financial reporting.

of the nature of the exceptions. When the auditor determines that the internal controls are not operating effectively, management should be informed in a timely manner. If the tests were performed prior to year-end, this may allow management to correct the deficiency before year-end. The auditor is required to communicate

in writing to those charged with governance, such as the audit committee, regarding significant deficiencies and material weaknesses in internal control.

As Figure 15-4 (p. 513) illustrates, in the Hillsburg audit, SER exceed TER for two attributes (4 and 8). Because the sales transactions tested at Hillsburg represented transactions recorded only through October 31, 2013, timely communication of these deficiencies may allow Hillsburg management to correct the noted deficiencies in time for the auditor to test the corrected controls before year-end for purposes of auditing internal control over financial reporting.

In Figure 15-5 (p. 515), the last column summarizes the follow-up actions the auditor plans to do regardless of whether the control deficiencies were corrected.

FIGURE 15-6 **Evidence-Planning Worksheet to Decide Tests of Details of Balances for Hillsburg Hardware Co.—Accounts Receivable**

	Detail tie-in	Existence	Completeness	Accuracy	Classification	Cutoff	Realizable value	Rights
Acceptable audit risk	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Inherent risk	Low	Medium	Low	Low	Low	Medium	Medium	Low
Control risk—Sales	Low	Medium	Low	High	Low	Medium	High	Not applicable
Control risk—Cash receipts	Low	Medium	Low	Low	Low	Low	Not applicable	Not applicable
Control risk—Additional controls	None	None	None	None	None	None	None	Low
Substantive tests of transactions—Sales	Good results	Good results	Good results	Fair results	Good results	Unacceptable results	Not applicable	Not applicable
Substantive tests of transactions—Cash receipts	Good results	Good results	Good results	Good results	Good results	Good results	Not applicable	Not applicable
Analytical procedures								
Planned detection risk for tests of details of balances								
Planned audit evidence for tests of details of balances								

Performance materiality $265,000

Because the difference between SER and TER was small for attributes 2 and 5, Figure 15-5 includes follow-up actions in the financial statement audit for those attributes. No follow-up actions are required to address the exception noted for attribute 6, given the large difference between SER and TER. The conclusions reached about each attribute are also documented at the bottom of Figure 15-4.

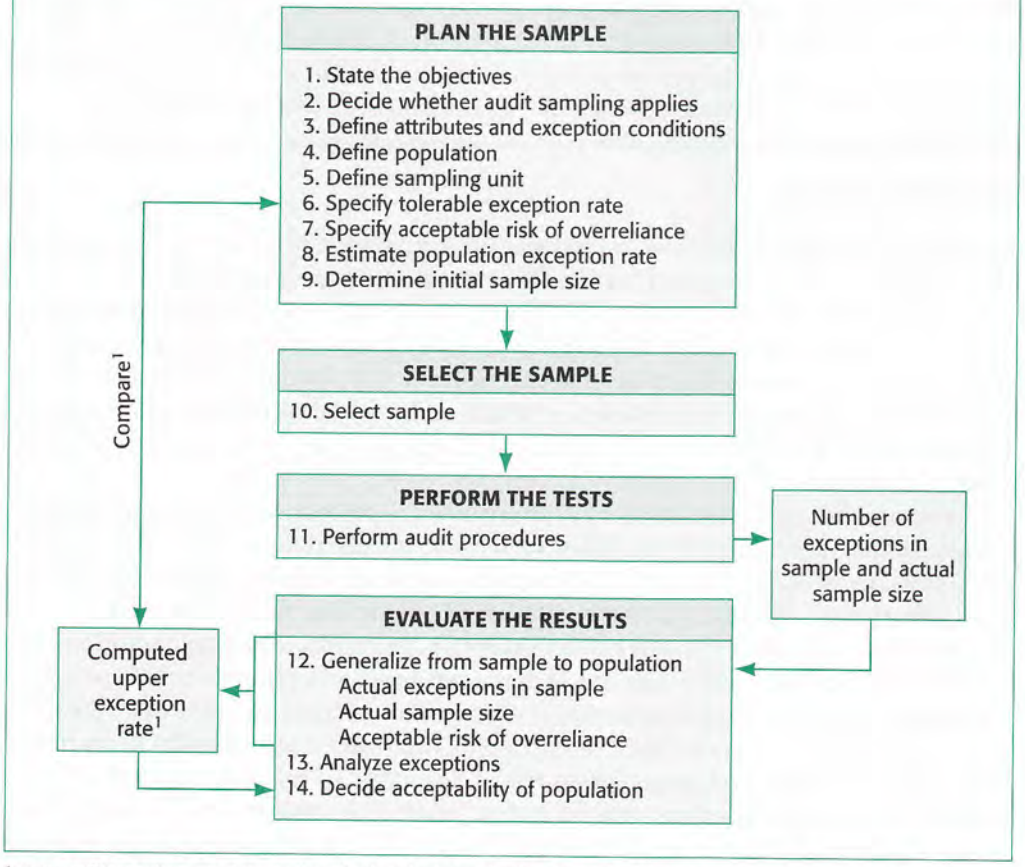
Adequate Documentation

The auditor needs to retain adequate records of the procedures performed, the methods used to select the sample and perform the tests, the results found in the tests, and the conclusions reached. Documentation is needed for both statistical and nonstatistical sampling to evaluate the combined results of all tests and to defend the audit if the need arises. Figures 15-2 through 15-6 illustrate the type of documentation commonly found in practice.

Figure 15-6 illustrates the evidence-planning worksheet used in the audit of Hillsburg Hardware to decide the tests of balances for accounts receivable. After completing tests of controls and substantive tests of transactions, the auditor should complete rows 3 through 7 of the worksheet. (You may recall that rows 1 and 2 were completed in Chapter 9.) Rows 3 through 5 document control risk for sales, cash receipts, and additional controls. The control risk assessments in Figure 15-6 are the same as the preliminary assessments in the control risk matrices for Hillsburg Hardware on pages 326 and 478, with the following modifications:

- Control risk is high for the accuracy objective for sales because of the unsatisfactory results for attribute 4 (procedure 13b).

FIGURE 15-7 Summary of Audit Sampling Steps



[1]Many auditors using nonstatistical methods calculate tolerable exception rate minus sample exception rate and evaluate whether the difference is sufficiently large.

- Control risk is high for the realizable value objective for accounts receivable based on the results for attribute 8 related to credit approval for sales transactions (procedure 13e).
- The occurrence (completeness) objective for cash receipts relates to the completeness (existence) objective for accounts receivable.

Finally, note in Figure 15-6 (p. 516) that all substantive tests of transactions results were satisfactory except for the accuracy and cutoff objectives for sales. Refer back to Figure 15-5 (p. 515) and you can see that:

- Substantive tests of transactions results for the accuracy objective were only fair because of exceptions found for attribute 2 (procedure 13a).
- Results were unacceptable for the cutoff objective because of unsatisfactory results for attribute 5 (procedure 13c).

All of the steps involved in nonstatistical sampling are summarized in Figure 15-7 (p. 517). Although this figure deals with nonstatistical sampling, the 14 steps in the figure also apply to statistical sampling, which is covered next.

STATISTICAL AUDIT SAMPLING

OBJECTIVE 15-6

Define and describe attributes sampling and a sampling distribution.

The statistical sampling method most commonly used for tests of controls and substantive tests of transactions is **attributes sampling**. (When the term *attributes sampling* is used in this text, it refers to attributes statistical sampling. Nonstatistical sampling also has attributes, which are the characteristics being tested for in the population, but attributes sampling is a statistical method.)

The application of attributes sampling for tests of controls and substantive tests of transactions has far more similarities to nonstatistical sampling than differences. The same 14 steps are used for both approaches, and the terminology is essentially the same. The main differences are the calculation of initial sample sizes using tables developed from statistical probability distributions and the calculation of estimated upper exception rates using tables similar to those for calculating sample sizes.

SAMPLING DISTRIBUTION

Auditors base their statistical inferences on sampling distributions. A **sampling distribution** is a frequency distribution of the results of all possible samples of a specified size that could be obtained from a population containing some specific characteristics. Sampling distributions allow the auditor to make probability statements about the likely representativeness of any sample that is in the distribution. Attributes sampling is based on the binomial distribution, in which each possible sample in the population has one of two possible values, such as yes/no, black/white, or control deviation/no control deviation.

Assume that in a population of sales invoices, 5 percent have no shipping documents attached as required by the client's internal controls. If the auditor takes a sample of 50 sales invoices, how many will be found that have no shipping documents? Simple multiplication would estimate 2.5 exceptions (5% of 50), but that number is impossible because there is no such thing as half an exception. In reality, the sample could contain no exceptions or even more than ten. A binomial-based sampling distribution tells us the probability of each possible number of exceptions occurring. Table 15-7 illustrates the sampling distribution for the example population with a sample of 50 items from a very large population and an exception rate of 5 percent. To calculate the probability of obtaining a sample with at least one exception, subtract the probability of no exceptions occurring from 1 (100 percent). By doing so, we find the likelihood of finding a sample with at least one exception is 1 – .0769, or 92.31 percent.

TABLE 15-7	Probability of Each Exception Rate – 5 Percent Population Exception Rate and Sample Size of 50		
Number of Exceptions	**Percentage of Exception**	**Probability**	**Cumulative Probability**
0	0	.0769	.0769
1	2	.2025	.2794
2	4	.2611	.5405
3	6	.2199	.7604
4	8	.1360	.8964
5	10	.0656	.9620
6	12	.0260	.9880
7	14	.0120	1.0000

Each population exception rate and sample size has a unique sampling distribution. The distribution for a sample size of 100 from a population with a 5 percent exception rate differs from the previous example, as will the distribution for a sample of 50 from a population with a 3 percent exception rate.

Of course, auditors do not take repeated samples from known populations. They take one sample from an unknown population and get a specific number of exceptions in that sample. But knowledge about sampling distributions enables auditors to make statistically valid statements about the population. If the auditor selects a sample of 50 sales invoices to test for attached shipping documents and finds one exception, the auditor could examine the probability table in Table 15-7 and know there is a 20.25 percent probability that the sample came from a population with a 5 percent exception rate, and a 79.75 percent (1 – .2025) probability that the sample was taken from a population having some other exception rate. Based on the cumulative probabilities column in Table 15-7, an auditor could estimate a 27.94 percent probability that the sample came from a population with more than a 5 percent exception rate and a 72.06 percent (1 – .2794) probability that the sample was taken from a population having an exception rate of 5 percent or less. Because it is also possible to calculate the probability distributions for other population exception rates, auditors use these to draw statistical conclusions about the unknown population being sampled. These sampling distributions are the basis for the tables used by auditors for attributes sampling.

APPLICATION OF ATTRIBUTES SAMPLING

OBJECTIVE 15-7

Use attributes sampling in tests of controls and substantive tests of transactions.

The steps discussed for nonstatistical sampling are equally applicable to attributes sampling. In this section, we'll focus on the differences between the two sampling methods.

Plan the Sample

1. *State the objectives of the audit test.* Same for attributes and nonstatistical sampling.
2. *Decide whether audit sampling applies.* Same for attributes and nonstatistical sampling.
3. *Define attributes and exception conditions.* Same for attributes and nonstatistical sampling.
4. *Define the population.* Same for attributes and nonstatistical sampling.
5. *Define the sampling unit.* Same for attributes and nonstatistical sampling.

6. *Specify the tolerable exception rate.* Same for attributes and nonstatistical sampling.
7. *Specify acceptable risk of overreliance.* The concepts of specifying this risk are the same for both statistical and nonstatistical sampling, but the method of quantification is usually different. For nonstatistical sampling, most auditors use low, medium, or high acceptable risk, whereas auditors using attributes sampling assign a specific amount, such as 10 percent or 5 percent risk. The methods differ because auditors need to evaluate results statistically.
8. *Estimate the population exception rate.* Same for attributes and nonstatistical sampling.
9. *Determine the initial sample size.* Four factors determine the initial sample size for both statistical and nonstatistical sampling: population size, TER, ARO, and EPER. In attributes sampling, auditors determine sample size by using computer programs or tables developed from statistical formulas.

The two tables in Table 15-8 (p. 522) come from the AICPA *Audit Sampling Guide.* The top one shows sample sizes for a 5 percent ARO, while the bottom one is for a 10 percent ARO.

Use of the Tables When auditors use the tables to determine initial sample size, they follow these four steps:

i. Select the table corresponding to the ARO.
ii. Locate the TER at the top of the table.
iii. Locate the EPER in the far left column.
iv. Read down the appropriate TER column until it intersects with the appropriate EPER row. The number at the intersection is the initial sample size.

Using the Hillsburg Hardware Co. example, assume that an auditor is willing to reduce assessed control risk for the agreement between sales orders and invoices if the number of exceptions in the population (attribute 6 in Table 15-3 on page 505) does not exceed 7 percent (TER), at a 5 percent ARO. On the basis of past experience, the auditor sets EPER at 1 percent. On the 5 percent ARO table, locate the 7 percent TER column, and read down the column until it intersects with the 1 percent EPER row. The initial sample size is 66.

Is 66 a large enough sample size for this audit? It is not possible to decide until after the tests have been performed. If the actual exception rate in the sample turns out to be greater than 1 percent, the auditor will be unsure of the effectiveness of the control. The reasons will become apparent in the following sections.

Effect of Population Size In the preceding discussion, auditors ignored the size of the population in determining the initial sample size. Statistical theory shows that in populations where attributes sampling applies, population size is a minor consideration in determining sample size. Because most auditors use attributes sampling for reasonably large populations, the reduction of sample size for smaller populations is ignored here.

Select the Sample and Perform the Audit Procedures

10. *Select the sample.* The only difference in sample selection for statistical and nonstatistical sampling is the requirement that probabilistic methods must be used for statistical sampling. Either simple random or systematic sampling is used for attributes sampling.
11. *Perform the audit procedures.* Same for attributes and nonstatistical sampling.

Evaluate the Results

12. *Generalize from the sample to the population.* For attributes sampling, the auditor calculates an upper precision limit (CUER) at a specified ARO, again using special computer programs or tables developed from statistical formulas. The calculations are illustrated in tables like Table 15-9 (p. 523).

These are "one-sided tables," meaning they represent the upper exception rate for a given ARO.

Use of the Tables Use of tables to compute CUER involves four steps:

i. Select the table corresponding to the auditor's ARO. This ARO should be the same as the ARO used for determining the initial sample size.
ii. Locate the actual number of exceptions found in the audit tests at the top of the table.
iii. Locate the actual sample size in the far left column.
iv. Read down the appropriate actual number of exceptions column until it intersects with the appropriate sample size row. The number at the intersection is the CUER.

To use the evaluation table for Hillsburg Hardware, assume an actual sample size of 70 and one exception in attribute 6. Using an ARO of 5 percent, CUER equals 6.6 percent. In other words, the CUER for attribute 6 is 6.6 percent at a 5 percent ARO. Does this mean that if 100 percent of the population were tested, the true exception rate will be 6.6 percent? No, the true exception rate remains unknown. What this result means is this: if the auditor concludes that the true exception rate does not exceed 6.6 percent, there is a 95 percent probability that the conclusion is right and a 5 percent chance that it is wrong.

It is possible to have a sample size that is not equal to those provided for in the attributes sampling evaluation tables. When this occurs, it is common for auditors to interpolate to estimate the data points that fall between those listed in the table.

These tables assume a very large (infinite) population size, which results in a more conservative CUER than for smaller populations. As with sample size, the effect of population size on CUER is typically very small, so it is ignored.

13. *Analyze exceptions.* Same for attributes and nonstatistical sampling.
14. *Decide the acceptability of the population.* The methodology for deciding the acceptability of the population is essentially the same for attributes and nonstatistical sampling. For attributes sampling, the auditor compares CUER with TER for each attribute. Before the population can be considered acceptable, the CUER determined on the basis of the actual sample results must be *less than or equal to* TER when both are based on the same ARO. In our example, when the auditor specified a TER of 7 percent at a 5 percent ARO and the CUER was 6.6 percent, the requirements of the sample have been met. In this case, the control being tested can be used to reduce assessed control risk as planned, provided a careful analysis of the cause of exceptions does not indicate the possibility of a significant problem in an aspect of the control not previously considered.

    When the CUER is greater than the TER, it is necessary to take specific action. The four courses of action discussed for nonstatistical sampling are equally applicable to attributes sampling.

Figure 15-8 (p. 524) illustrates the sampling documentation completed for the tests of attributes 1 through 9 in Table 15-3 for Hillsburg Hardware Co. using attributes sampling. Notice that much of the information in Figure 15-8 is consistent with information presented in the nonstatistical sampling example illustrated in Figure 15-4 (p. 513). The key differences between Figures 15-4 and 15-8 are the auditor's judgment about ARO and the initial sample size determined when planning the audit, and the calculation of CUER using the actual test results. Notice that the ARO judgment is numerical (5 percent) in the attributes sampling application (Figure 15-8). The numerical judgment about ARO is considered along with the assessments of EPER and TER to determine the initial sample sizes for each attribute using Table 15-8. The CUER in Figure 15-8 is determined using Table 15-9 based on the sample exceptions identified and the actual sample size tested.

TABLE 15-8 Determining Sample Size for Attributes Sampling*

5 PERCENT RISK OF OVERRELIANCE

Estimated Population Exception Rate (in Percent)	Tolerable Exception Rate (in Percent)										
	2	3	4	5	6	7	8	9	10	15	20
0.00	149	99	74	59	49	42	36	32	29	19	14
0.25	236	157	117	93	78	66	58	51	46	30	22
0.50	313	157	117	93	78	66	58	51	46	30	22
0.75	386	208	117	93	78	66	58	51	46	30	22
1.00		257	156	93	78	66	58	51	46	30	22
1.25		303	156	124	78	66	58	51	46	30	22
1.50		392	192	124	103	66	58	51	46	30	22
1.75			227	153	103	88	77	51	46	30	22
2.00			294	181	127	88	77	68	46	30	22
2.25			390	208	127	88	77	68	61	30	22
2.50				234	150	109	77	68	61	30	22
2.75				286	173	109	95	68	61	30	22
3.00				361	195	129	95	84	61	30	22
3.25				458	238	148	112	84	61	30	22
3.50					280	167	112	84	76	40	22
3.75					341	185	129	100	76	40	22
4.00					421	221	146	100	89	40	22
5.00						478	240	158	116	40	30
6.00								266	179	50	30
7.00									298	68	37

10 PERCENT RISK OF OVERRELIANCE

Estimated Population Exception Rate (in Percent)	Tolerable Exception Rate (in Percent)										
	2	3	4	5	6	7	8	9	10	15	20
0.00	114	76	57	45	38	32	28	25	22	15	11
0.25	194	129	96	77	64	55	48	42	38	25	18
0.50	194	129	96	77	64	55	48	42	38	25	18
0.75	265	129	96	77	64	55	48	42	38	25	18
1.00	398	176	96	77	64	55	48	42	38	25	18
1.25		221	132	77	64	55	48	42	38	25	18
1.50		265	132	105	64	55	48	42	38	25	18
1.75		390	166	105	88	55	48	42	38	25	18
2.00			198	132	88	75	48	42	38	25	18
2.25			262	132	88	75	65	42	38	25	18
2.50			353	158	110	75	65	58	38	25	18
2.75			471	209	132	94	65	58	52	25	18
3.00				258	132	94	65	58	52	25	18
3.25				306	153	113	82	58	52	25	18
3.50				400	194	113	82	73	52	25	18
3.75					235	131	98	73	52	25	18
4.00					274	149	98	73	65	25	18
5.00						318	160	115	78	34	18
6.00							349	182	116	43	25
7.00								385	199	52	25
8.00									424	60	25

Notes: 1. This table assumes a large population. 2. Tables do not include higher estimated population exception rates, and sample sizes over 500 are not reported. 3. Sample sizes are the same in certain columns even when estimated population exception rates differ because of the method of constructing the tables. Sample sizes are calculated for attributes sampling by using the expected number of exceptions in the population, but auditors can deal more conveniently with estimated population exception rates. For example, in the 15 percent column for tolerable exception rate, at an ARO of 5 percent, the initial sample size for most EPERs is 30. One exception, divided by a sample size of 30, is 3.3 percent. Therefore, for all EPERs greater than zero but less than 3.3 percent, the initial sample size is the same.

*Source: Data from AICPA *Audit Sampling* Audit Guide, March 1, 2012 (www.aicpa.org).

TABLE 15-9 Evaluating Sample Results Using Attributes Sampling*

5 PERCENT RISK OF OVERRELIANCE											
	Actual Number of Exceptions Found										
Sample Size	0	1	2	3	4	5	6	7	8	9	10
20	14.0	21.7	28.3	34.4	40.2	45.6	50.8	55.9	60.7	65.4	69.9
25	11.3	17.7	23.2	28.2	33.0	37.6	42.0	46.3	50.4	54.4	58.4
30	9.6	14.9	19.6	23.9	28.0	31.9	35.8	39.4	43.0	46.6	50.0
35	8.3	12.9	17.0	20.7	24.3	27.8	31.1	34.4	37.5	40.6	43.7
40	7.3	11.4	15.0	18.3	21.5	24.6	27.5	30.4	33.3	36.0	38.8
45	6.5	10.2	13.4	16.4	19.2	22.0	24.7	27.3	29.8	32.4	34.8
50	5.9	9.2	12.1	14.8	17.4	19.9	22.4	24.7	27.1	29.4	31.6
55	5.4	8.4	11.1	13.5	15.9	18.2	20.5	22.6	24.8	26.9	28.9
60	4.9	7.7	10.2	12.5	14.7	16.8	18.8	20.8	22.8	24.8	26.7
65	4.6	7.1	9.4	11.5	13.6	15.5	17.5	19.3	21.2	23.0	24.7
70	4.2	6.6	8.8	10.8	12.7	14.5	16.3	18.0	19.7	21.4	23.1
75	4.0	6.2	8.2	10.1	11.8	13.6	15.2	16.9	18.5	20.1	21.6
80	3.7	5.8	7.7	9.5	11.1	12.7	14.3	15.9	17.4	18.9	20.3
90	3.3	5.2	6.9	8.4	9.9	11.4	12.8	14.2	15.5	16.9	18.2
100	3.0	4.7	6.2	7.6	9.0	10.3	11.5	12.8	14.0	15.2	16.4
125	2.4	3.8	5.0	6.1	7.2	8.3	9.3	10.3	11.3	12.3	13.2
150	2.0	3.2	4.2	5.1	6.0	6.9	7.8	8.6	9.5	10.3	11.1
200	1.5	2.4	3.2	3.9	4.6	5.2	5.9	6.5	7.2	7.8	8.4
10 PERCENT RISK OF OVERRELIANCE											
	Actual Number of Exceptions Found										
Sample Size	0	1	2	3	4	5	6	7	8	9	10
20	10.9	18.1	24.5	30.5	36.1	41.5	46.8	51.9	56.8	61.6	66.2
25	8.8	14.7	20.0	24.9	29.5	34.0	38.4	42.6	46.8	50.8	54.8
30	7.4	12.4	16.8	21.0	24.9	28.8	32.5	36.2	39.7	43.2	46.7
35	6.4	10.7	14.5	18.2	21.6	24.9	28.2	31.4	34.5	37.6	40.6
40	5.6	9.4	12.8	16.0	19.0	22.0	24.9	27.7	30.5	33.2	35.9
45	5.0	8.4	11.4	14.3	17.0	19.7	22.3	24.8	27.3	29.8	32.2
50	4.6	7.6	10.3	12.9	15.4	17.8	20.2	22.5	24.7	27.0	29.2
55	4.2	6.9	9.4	11.8	14.1	16.3	18.4	20.5	22.6	24.6	26.7
60	3.8	6.4	8.7	10.8	12.9	15.0	16.9	18.9	20.8	22.7	24.6
65	3.5	5.9	8.0	10.0	12.0	13.9	15.7	17.5	19.3	21.0	22.8
70	3.3	5.5	7.5	9.3	11.1	12.9	14.6	16.3	18.0	19.6	21.2
75	3.1	5.1	7.0	8.7	10.4	12.1	13.7	15.2	16.8	18.3	19.8
80	2.9	4.8	6.6	8.2	9.8	11.3	12.8	14.3	15.8	17.2	18.7
90	2.6	4.3	5.9	7.3	8.7	10.1	11.5	12.8	14.1	15.4	16.7
100	2.3	3.9	5.3	6.6	7.9	9.1	10.3	11.5	12.7	13.9	15.0
125	1.9	3.1	4.3	5.3	6.3	7.3	8.3	9.3	10.2	11.2	12.1
150	1.6	2.6	3.6	4.4	5.3	6.1	7.0	7.8	8.6	9.4	10.1
200	1.2	2.0	2.7	3.4	4.0	4.6	5.3	5.9	6.5	7.1	7.6

Note: This table presents computed upper exception rates as percentages. Table assumes a large population. Sample sizes greater than 200 not shown.

*Source: Data from AICPA *Audit Sampling* Audit Guide, March 1, 2012 (www.aicpa.org).

Need for Professional Judgment

A criticism occasionally leveled against statistical sampling is that it reduces the auditor's use of professional judgment. A comparison of the 14 steps discussed in this chapter for nonstatistical and attributes sampling shows that this criticism is unwarranted. For proper application, attributes sampling requires auditors to use professional judgment in most of the steps. To select the initial sample size, auditors depend primarily on TER and ARO, which require a high level of professional

FIGURE 15-8 **Attributes Sampling Data Sheet: Tests of Hillsburg Hardware Co.'s Billing Function**

Client: Hillsburg Hardware
Audit Area: Tests of Controls and Substantive Tests of Transactions—Billing Function

Year-end: 12/31/13
Pop. size: 5,764

Define the objective(s): Examine duplicate sales invoices and related documents to determine whether the system has functioned as intended and as described in the audit program.

Define the population precisely (including stratification, if any): Sales invoices for the period 1/1/13 to 10/31/13. First invoice number = 3689. Last invoice number = 9452.

Define the sampling unit, organization of population items, and random selection procedures: Sales invoice number, recorded in the sales journal sequentially; computer generation of random numbers.

	Planned Audit				Actual Results			
Description of Attributes	**EPER**	**TER**	**ARO**	**Initial sample size**	**Sample size**	**Number of exceptions**	**Sample exception rate**	**CUER**
1. Existence of the sales invoice number in the sales journal (procedure 12).	0	4	5	74	75	0	0	4.0
2. Amount and other data in the master file agree with sales journal entry (procedure 13a).	1	5	5	93	100	2	2	6.2
3. Amount and other data on the duplicate sales invoice agree with the sales journal entry (procedure 13b).	1	5	5	93	100	0	0	3.0
4. Evidence that pricing, extensions, and footings are checked (initials and correct amounts) (procedure 13b).	1	5	5	93	100	10	10	16.4
5. Quantity and other data on the bill of lading agree with the duplicate sales invoice and sales journal (procedure 13c).	1	5	5	93	100	4	4	9.0
6. Quantity and other data on the sales order agree with the duplicate sales invoice (procedure 13d).	1	7	5	66	70	1	1.5	6.6
7. Quantity and other data on the customer order agree with the duplicate sales invoice (procedure 13e).	1.5	9	5	51	50	0	0	5.9
8. Credit is approved (procedure 13e).	1.5	9	5	51	50	10	20	31.6
9. For recorded sales in the sales journal, the file of supporting documents includes a duplicate sales invoice, bill of lading, sales order, and customer order (procedure 14).	1	7	5	66	65	0	0	4.6

Intended use of sampling results:

1. Effect on Audit Plan: Controls tested through attributes 1, 3, 6, 7, and 9 can be viewed as operating effectively given that TER equals or exceeds CUER. Additional emphasis is needed in confirmation, allowance for uncollectible accounts, cutoff tests, and price tests for the financial statement audit due to results of tests for attributes 2, 4, 5, and 8.

2. Effect on Report on Internal Control: CUER exceeds TER for attributes 2, 4, 5, and 8. These findings have been communicated to management to allow an opportunity for correction of the control deficiency to be made before year-end. If timely correction is made by management, the corrected controls will be tested before year-end for purposes of reporting on internal control over financial reporting.

3. Recommendations to Management: Each of the exceptions should be discussed with management. Specific recommendations are needed to correct the internal verification of sales invoices and to improve the approach to credit approvals.

judgment, as well as EPER, which requires a careful estimate. Similarly, the final evaluation of the adequacy of the entire application of attributes sampling, including the adequacy of the sample size, must also be based on high-level professional judgment.

SUMMARY

In this chapter we described representative samples and discussed the differences between statistical and nonstatistical sampling and probabilistic and nonprobabilistic sample selection. We also described the 14 steps in sampling for exception rates used in tests of controls and substantive tests of transactions. Nonstatistical and statistical attributes sampling for exception rates were illustrated for the Hillsburg Hardware Co.

ESSENTIAL TERMS

Acceptable risk of overreliance (ARO)—the risk that the auditor is willing to take of accepting a control as effective or a rate of monetary misstatements as tolerable when the true population exception rate is greater than the tolerable exception rate

Attribute—the characteristic being tested for in the population

Attributes sampling—a statistical, probabilistic method of sample evaluation that results in an estimate of the proportion of items in a population containing a characteristic or attribute of interest

Audit sampling—testing less than 100 percent of a population for the purpose of making inferences about that population

Block sample selection—a nonprobabilistic method of sample selection in which items are selected in measured sequences

Computed upper exception rate (CUER)—the upper limit of the probable population exception rate; the highest exception rate in the population at a given ARO

Estimated population exception rate (EPER)—exception rate the auditor expects to find in the population before testing begins

Exception rate—the percent of items in a population that include exceptions in prescribed controls or monetary correctness

Haphazard sample selection—a nonprobabilistic method of sample selection in which items are chosen without regard to their size, source, or other distinguishing characteristics

Initial sample size—sample size determined by professional judgment (nonstatistical sampling) or by statistical tables (attributes sampling)

Nonprobabilistic sample selection—a method of sample selection in which the auditor uses professional judgment to select items from the population

Nonsampling risk—the risk that the auditor fails to identify existing exceptions in the sample; nonsampling risk (nonsampling error) is caused by failure to recognize exceptions and by inappropriate or ineffective audit procedures

Nonstatistical sampling—a sampling procedure that does not permit the numerical measurement of the sampling risk

Occurrence rate—see exception rate

Probabilistic sample selection—a method of selecting a sample such that each population item has a known probability of being included in the sample and the sample is selected by a random process

Random sample—a sample in which every possible combination of elements in the population has an equal chance of constituting the sample

Representative sample—a sample with characteristics the same as those of the population

Sample exception rate (SER)—number of exceptions in the sample divided by the sample size

Sampling distribution—a frequency distribution of the results of all possible samples of a specified size that could be obtained from a population containing some specific parameters

Sampling risk—risk of reaching an incorrect conclusion inherent in tests of less than the entire population because the sample is not representative of the population; sampling risk may be reduced by using an increased sample size and an appropriate method of selecting sample items from the population

Statistical sampling—the use of mathematical measurement techniques to calculate formal statistical results and quantify sampling risk

Systematic sample selection—a probabilistic method of sampling in which the auditor calculates an interval (the population size divided by the number of sample items desired) and selects the items for the sample based on the size of the interval and a randomly selected starting point between zero and the length of the interval

Tolerable exception rate (TER)—the exception rate that the auditor will permit in the population and still be willing to conclude the control is operating effectively and/or the amount of monetary misstatements in the transactions established during planning is acceptable

REVIEW QUESTIONS

15-1 (Objective 15-1) State what is meant by a representative sample and explain its importance in sampling audit populations.

15-2 (Objective 15-2) Explain the major difference between statistical and nonstatistical sampling. What are the three main parts of statistical and nonstatistical methods?

15-3 (Objective 15-3) Explain the difference between replacement sampling and nonreplacement sampling. Which method do auditors usually follow? Why?

15-4 (Objective 15-3) What are the two types of simple random sample selection methods? Which of the two methods is used most often by auditors and why?

15-5 (Objective 15-3) Describe systematic sample selection and explain how an auditor will select 40 numbers from a population of 2,800 items using this approach. What are the advantages and disadvantages of systematic sample selection?

15-6 (Objective 15-4) What is the purpose of using nonstatistical sampling for tests of controls and substantive tests of transactions?

15-7 (Objective 15-2) Explain what is meant by block sample selection and describe how an auditor can obtain five blocks of 20 sales invoices from a sales journal.

15-8 (Objective 15-5) Define each of the following terms:

a. Acceptable risk of overreliance (ARO)
b. Computed upper exception rate (CUER)
c. Estimated population exception rate (EPER)
d. Sample exception rate (SER)
e. Tolerable exception rate (TER)

15-9 (Objective 15-5) Describe what is meant by a sampling unit. Explain why the sampling unit for verifying the occurrence of recorded sales differs from the sampling unit for testing for the possibility of omitted sales.

15-10 (Objective 15-5) Distinguish between the TER and the CUER. How is each determined?

15-11 (Objective 15-1) Distinguish between a sampling error and a nonsampling error. How can each be reduced?

15-12 (Objective 15-4) What is meant by an attribute in sampling for tests of controls and substantive tests of transactions? What is the source of the attributes that the auditor selects?

15-13 (Objective 15-4) Explain the difference between an attribute and an exception condition. State the exception condition for the audit procedure: The duplicate sales invoice has been initialed indicating the performance of internal verification.

15-14 (Objective 15-5) Identify the factors an auditor uses to decide the appropriate TER. Compare the sample size for a TER of 7% with that of 4%, all other factors being equal.

15-15 (Objective 15-5) Identify the factors an auditor uses to decide the appropriate ARO. Compare the sample size for an ARO of 10% with that of 5%, all other factors being equal.

15-16 (Objective 15-5) State the relationship between the following:

a. ARO and sample size
b. Population size and sample size
c. TER and sample size
d. EPER and sample size

15-17 (Objective 15-7) Assume that the auditor has selected 100 sales invoices from a population of 100,000 to test for an indication of internal verification of pricing and extensions. Determine the CUER at a 10% ARO if four exceptions are found in the sample using attributes sampling. Explain the meaning of the statistical results in auditing terms.

15-18 (Objective 15-5) Explain what is meant by analysis of exceptions and discuss its importance.

15-19 (Objective 15-5) When the CUER exceeds the TER, what courses of action are available to the auditor? Under what circumstances should each of these be followed?

15-20 (Objective 15-3) Distinguish between probabilistic selection and statistical measurement. State the circumstances under which one can be used without the other.

15-21 (Objective 15-7) List the major decisions that the auditor must make in using attributes sampling. State the most important considerations involved in making each decision.

MULTIPLE CHOICE QUESTIONS FROM CPA EXAMINATIONS

15-22 (Objectives 15-5, 15-7) The following items apply to determining sample sizes using random sampling from large populations for attributes sampling. Select the most appropriate response for each question.

a. If all other factors specified in a sampling plan remain constant, changing the ARO from 5% to 10% will cause the required sample size to
   (1) increase.
   (2) remain the same.
   (3) decrease.
   (4) become indeterminate.

b. If all other factors specified in a sampling plan remain constant, changing the TER from 9% to 6% will cause the required sample size to
   (1) increase.
   (2) remain the same.
   (3) decrease.
   (4) become indeterminate.

c. Of the four factors that determine the initial sample size in attributes sampling (population size, tolerable exception rate, acceptable risk of overreliance, and expected population exception rate), which factor has the least effect on sample size?
   (1) Population size
   (2) Expected population exception rate
   (3) Tolerable exception rate
   (4) Acceptable risk of overreliance

d. The sample size of a test of controls varies inversely with:

	Expected population exception rate	Tolerable exception rate
(1)	No	Yes
(2)	Yes	No
(3)	No	No
(4)	Yes	Yes

15-23 (Objectives 15-5, 15-7) The following items concern determining exception rates using random sampling from large populations using attributes sampling. Select the best response.

a. From a random sample of items listed from a client's inventory count, an auditor estimates with a 90% confidence level that the CUER is between 4% and 6%. The auditor's major concern is that there is one chance in ten that the true exception rate in the population is
   (1) more than 6%.
   (2) less than 6%.
   (3) more than 4%.
   (4) less than 4%.

b. The upper precision limit (CUER) in statistical sampling is
   (1) the percentage of items in a sample that possess a particular attribute.
   (2) the percentage of items in a population that possess a particular attribute.
   (3) a statistical measure, at a specified confidence level, of the maximum rate of occurrence of an attribute.
   (4) the maximum rate of exception that the auditor would be willing to accept in the population without altering the planned reliance on the attribute.

c. In addition to evaluating the frequency of deviations in tests of controls, an auditor should also consider certain qualitative aspects of the deviations. The auditor most likely would give additional consideration to the implications of a deviation if it was
   (1) the only deviation discovered in the sample.
   (2) identical to a deviation discovered during the prior year's audit.
   (3) caused by an employee's misunderstanding of instructions.
   (4) initially concealed by a forged document.

d. An auditor who uses statistical sampling for attributes in testing internal controls should reduce the planned reliance on a prescribed control when the
   (1) sample exception rate plus the allowance for sampling risk equals the tolerable rate.
   (2) sample exception rate is less than the expected rate of exception used in planning the sample.
   (3) tolerable rate less the allowance for sampling risk exceeds the sample exception rate.
   (4) sample exception rate plus the allowance for sampling risk exceeds the tolerable rate.

15-24 (Objectives 15-1, 15-2) The following questions concern sampling for attributes. Choose the best response.

a. An advantage of statistical sampling over nonstatistical sampling is that statistical sampling helps an auditor
   (1) minimize the failure to detect errors and fraud.
   (2) eliminate the risk of nonsampling errors.
   (3) design more effective audit procedures.
   (4) measure the sufficiency of the audit evidence by quantifying sampling risk.

b. Which of the following best illustrates the concept of sampling risk?
   (1) The documents related to the chosen sample may not be available to the auditor for inspection.
   (2) An auditor may fail to recognize errors in the documents from the sample.
   (3) A randomly chosen sample may not be representative of the population as a whole for the characteristic of interest.
   (4) An auditor may select audit procedures that are not appropriate to achieve the specific objective.

c. For which of the following tests would an auditor most likely use attribute sampling?
   (1) Selecting accounts receivable for confirmation of account balances.
   (2) Inspecting employee time cards for proper approval by supervisors.
   (3) Making an independent estimate of the amount of a LIFO inventory.
   (4) Examining invoices in support of the valuation of fixed asset additions.

DISCUSSION QUESTIONS AND PROBLEMS

15-25 (Objective 15-3)

Required

a. In each of the following independent problems, design an unbiased random sampling plan, using an electronic spreadsheet or a random number generator program. The plan should include defining the sampling unit and establishing a numbering system for the population. After the plan has been designed, select the sample using the computer. Assume that the sample size is 75 for each of (1) through (4).
   (1) Prenumbered sales invoices in a sales journal where the lowest invoice number is 1 and the highest is 8274.
   (2) Prenumbered bills of lading where the lowest document number is 18221 and the highest is 29427.
   (3) Accounts receivable on 20 pages with 50 lines per page except the last page, which has only 29 full lines. Each line has a customer name and an amount receivable.
   (4) Prenumbered invoices in a sales journal where each month starts over with number 1. (Invoices for each month are designated by the month and document number.) There is a maximum of 25 pages per month with a total of 215 pages for the year. All pages have 100 invoices except for the last page for each month.

b. Using systematic sampling, select the first five sample items for populations (1) through (3) from part a., using the random starting points shown. Recall that the sample size is 75 in each case.
   (1) Invoice #39
   (2) Bill of lading #18259
   (3) Page 1, line #11

15-26 (Objectives 15-3, 15-5, 15-7) One of your clients, Van Damme Supply Company, is a medium-sized company that sells wholesale hardware supplies in the West Flanders province of Belgium. As a result of your recommendations, it has instituted a set of internal controls for sales. To control outgoing shipments of its products, the client uses prenumbered warehouse removal slips for every sale. Nothing should be removed from the warehouse without an authorized slip, and inventories are periodically taken to ensure that no products are unaccounted for. Once an order has been shipped, two copies of the removal slip are sent to the accounting department so that a sales invoice can be prepared. One copy is stapled to a duplicate copy of a prenumbered sales invoice, and the other is filed numerically. In certain cases, more than one warehouse removal slip may be used for billing a single sales invoice. This past year, the smallest warehouse removal slip number was 24587 and the largest was 50321. The smallest sales invoice number was 31247 and the largest was 64325. In the yearly audit of sales, one of the company's major concerns is the effectiveness of the controls designed to ensure that all shipments are billed. To test these internal controls, you have decided to use audit sampling.

Required

a. State an effective audit procedure for testing whether shipments have been billed. What is the sampling unit for the audit procedure?

b. Assume that you expect no exceptions in the sample but are willing to accept a TER of 3%. At a 10% ARACR, what is the appropriate sample size for the audit test? You may complete this requirement using attributes sampling.

c. Design a random selection plan for selecting the sample from the population, using either systematic sampling or the computer generation of random numbers. Use the sample size determined in part b. If you use systematic sampling, use a random starting point of 21378.

d. Your supervisor suggests the possibility of performing other sales tests with the same sample as a means of efficiently using your audit time. List two other audit procedures that could be performed using the same sample and state the purpose of each procedure.

e. Is it desirable to test the occurrence of sales with the random sample you have designed in part c.? Why?

15-27 (Objective 15-7) The following is a partial audit program for the audit of sales transactions.

1. Foot the sales journal for one month and trace the postings to the general ledger.
2. Review the sales journal for any large or unusual transactions.
3. Examine sales order for evidence of credit approval prior to shipment.
4. Vouch entries in sales journal to sales invoice and shipping document.
5. Examine evidence on sales invoice that the prices were agreed to the approved price list.
6. Recompute extensions of price and quantities on the sales invoice.
7. Trace entries in sales journal to entry in accounts receivable master file.

Required

a. Identify which audit procedures can be tested by using attributes sampling.

b. What is the appropriate sampling unit for the tests in part a.?

c. List the attributes for testing in part a.

d. Assume an ARO of 5% and a TER of 6% for tests of controls and 5% for substantive tests of transactions. The EPER for tests of controls is 1.0%, and for substantive tests of transactions it is 0.5%. What is the initial sample size for each attribute?

15-28 (Objectives 15-5, 15-7) The following questions concern the determination of the proper sample size in audit sampling using the following table:

	1	2	3	4	5	6	7
ARO (in percent)	10	5	5	5	10	10	5
TER	6	6	5	6	20	20	2
EPER (in percent)	2	2	2	2	8	2	0
Population size	1,000	100,000	6,000	1,000	500	500	1,000,000

Required

a. Assume that the initial sample size for column 1 using nonstatistical sampling is 90 items. For each of columns 2 through 7, use your judgment to decide the appropriate nonstatistical sample size. In deciding each sample size, consider the effects of changes in each of the four factors (ARO, TER, EPER, and population size) compared with column 1.

b. For each of the columns numbered 1 through 7, determine the initial sample size needed to satisfy the auditor's requirements using attributes sampling from the appropriate part of Table 15-8 (p. 522).

c. Using your understanding of the relationship between the following factors and sample size, state the effect on the initial sample size (increase or decrease) of changing each of the following factors while the other three are held constant:
   (1) An increase in ARO
   (2) An increase in the TER
   (3) An increase in the EPER
   (4) An increase in the population size

d. Explain why there is such a large difference in the sample sizes for columns 3 and 6.

e. Compare your answers in part c. with the results you determined in part a. (nonstatistical sampling) or part b. (attributes sampling). Which of the four factors appears to have the greatest effect on the initial sample size? Which one appears to have the least effect?

f. Why is the sample size called the initial sample size?

15-29 (Objectives 15-5, 15-7) The questions below relate to determining the CUER in audit sampling for tests of controls, using the following table:

	1	2	3	4	5	6	7	8
ARO (in percent)	5	5	10	5	5	5	5	5
Population size	50,000	500	5,000	5,000	5,000	900	5,000	500
Sample size	200	100	200	200	50	100	100	25
Number of exceptions	4	2	4	4	1	10	0	0

Required

a. Using nonstatistical sampling, calculate TER – SER for each of columns 1 through 8 and evaluate whether or not sampling error is large enough to accept the population. Assume that TER is 5% for each column.

b. For each of the columns 1 through 8, determine CUER using attributes sampling from the appropriate table.

c. Using your understanding of the relationship between the four preceding factors and the CUER, state the effect on the CUER (increase or decrease) of changing each of the following factors while the other three are held constant:
   (1) A decrease in the ARO
   (2) A decrease in the population size
   (3) A decrease in the sample size
   (4) A decrease in the number of exceptions in the sample

d. Compare your answers in part c. with the results you determined in part a. (nonstatistical sampling) or part b. (attributes sampling). Which of the factors appears to have the greatest effect on the CUER? Which one appears to have the least effect?

e. Why is it necessary to compare the CUER with the TER?

15-30 (Objective 15-7) The following are auditor judgments and attributes sampling results for six populations. Assume large population sizes.

	1	2	3	4	5	6
EPER (in percent)	2	1	1	0	3	8
TER (in percent)	6	5	20	3	8	15
ARO (in percent)	5	5	10	5	10	10
Actual sample size	100	100	20	100	60	60
Actual number of exceptions in the sample	2	4	1	0	1	8

Required

a. For each population, did the auditor select a smaller sample size than is indicated by using the attributes sampling tables in Table 15-8 for determining sample size? Evaluate selecting either a larger or smaller size than those determined in the tables.

b. Calculate the SER and CUER for each population.

c. For which of the six populations should the sample results be considered unacceptable? What options are available to the auditor?

d. Why is analysis of the exceptions necessary even when the populations are considered acceptable?

e. For the following terms, identify which is an audit decision, a nonstatistical estimate made by the auditor, a sample result, and a statistical conclusion about the population:
   (1) EPER
   (2) TER
   (3) ARO
   (4) Actual sample size
   (5) Actual number of exceptions in the sample
   (6) SER
   (7) CUER

15-31 (Objectives 15-5, 15-7) The questions below relate to determining the CUER in audit sampling for tests of controls, using the following table:

	1	2	3	4
ARO (in percent)	10	10	5	5
Population size	5,000	50,000	5,000	50,000
Sample size	50	100	50	100
Number of exceptions	2	4	2	3
CUER	10.3	7.9	12.1	7.6

Required

a. Calculate SER for each of columns 1 through 4 and use this to calculate the actual allowance for sampling risk.
b. Explain why the CUER is higher for the attribute in column 1 than the attribute in column 2.
c. Explain why the CUER higher for the attribute in column 3 than the attribute in column 1.
d. Assume that the TER for attribute 4 is 6 percent. Your audit senior indicates that he would like to be able to rely on this control and has asked you to increase the sample by an additional 50 items. Use the appropriate statistical sampling table to evaluate whether the increase in the sample is likely to result in favorable results for the entire sample of 150 items.

15-32 (Objective 15-5) For the audit of the financial statements of Mercury Fifo Company, Stella Mason, CPA, has decided to apply nonstatistical audit sampling in the tests of controls and substantive tests of transactions for sales transactions. Based on her knowledge of Mercury's operations in the area of sales, she decides that the EPER is likely to be 3% and that she is willing to accept a 5% risk that the true population exception rate is not greater than 6%. Given this information, Mason selects a random sample of 150 sales invoices from the 5,000 generated during the year and examines them for exceptions. She notes the following exceptions in her audit schedules. There is no other documentation.

Invoice No.	Comment
5028	Sales invoice was originally footed incorrectly but was corrected by client before the bill was sent out.
6791	Voided sales invoice examined by auditor.
6810	Shipping document for a sale of merchandise could not be located.
7364	Sales invoice for $2,875 has not been collected and is 6 months past due.
7625	Client unable to locate the duplicate sales invoice.
8431	Invoice was dated 3 days later than the date entered in the sales journal.
8528	Customer order is not attached to the duplicate sales invoice.
8566	Billing is for $100 less than it should be due to an unintentional pricing error. No indication of internal verification is included on the invoice.
8780	Client unable to locate the duplicate sales invoice.
9169	Credit not authorized, but the sale was for only $7.65.
9974	Lack of indication of internal verification of price extensions and postings of sales invoice.

Required

a. Which of the preceding should be defined as an exception?
b. Explain why it is inappropriate to set a single acceptable TER and EPER for the combined exceptions.
c. Calculate SER for each attribute tested in the population. (You must decide which attributes should be combined, which should be kept separate, and which exceptions are actual exceptions before you can calculate SER.)
d. Calculate TER – SER for each attribute and evaluate whether sampling error is sufficiently large given the 5% ARO. Assume TER is 6% for each attribute.
e. State the appropriate analysis of exceptions for each of the exceptions in the sample, including additional procedures to be performed.

15-33 (Objectives 15-6, 15-7) The sampling data sheet below is missing selected information for six attributes involving tests of transactions for the sales and collection cycle.

	Planned Audit				Actual Results		
Attributes	EPER	TER	ARO	Initial Sample Size	Sample Size	Number of Exceptions	CUER
Attribute 1	0%	6%	5%	49	50	1	____
Attribute 2	0.50%	5%	10%	___	80	0	2.9%
Attribute 3	1%	____	10%	55	55	1	6.9%
Attribute 4	1%	6%	5%	78	80	___	5.8%
Attribute 5	0%	4%	____	74	80	0	3.7%
Attribute 6	0.50%	6%	10%	64	___	2	7.5%

Required

a. Use Table 15-8 (p. 522) and Table 15-9 (p. 523) to complete the missing information for each attribute.

b. For which attributes are the sample results unacceptable?

c. Compare attributes 1 and 3. Why does attribute 1 have the smaller sample size?

d. Compare attributes 2 and 5. Why is CUER higher for attribute 5?

CASE

15-34 (Objectives 15-4, 15-5, 15-7) Jean-Paul Dupont, CPA is conducting a test of sales for 9 months of the year ended December 31, 2013, for the audit of Garnier Mineral Enterprises. Included among her audit procedures are the following:

1. Foot and cross-foot the sales journal and trace the balance to the general ledger.
2. Review all sales transactions for reasonableness.
3. Select a sample of recorded sales from the sales journal and trace the customer name and amounts to duplicate sales invoices and the related shipping document.
4. Select a sample of shipping document numbers and perform the following tests:
   a. Trace the shipping document to the related duplicate sales invoice.
   b. Examine the duplicate sales invoice to determine whether copies of the shipping document, shipping order, and customer order are attached.
   c. Examine the shipping order for an authorized credit approval.
   d. Examine the duplicate sales invoice for an indication of internal verification of quantity, price, extensions, footings, and trace the balance to the accounts receivable master file.
   e. Compare the price on the duplicate sales invoice with the approved price list and the quantity with the shipping document.
   f. Trace the balance in the duplicate sales invoice to the sales journal and accounts receivable master file for customer name, amount, and date.

Required

a. For which of these procedures can audit sampling for exceptions be conveniently used?

b. Considering the audit procedures Dupont developed, what is the most appropriate sampling unit for conducting most of the audit sampling tests?

c. Set up a sampling data sheet using attributes or nonstatistical sampling. For all tests of controls, assume a TER rate of 5% and an EPER of 1%. For all substantive tests of transactions, use a 4% TER and a 0% EPER. Use a 10% ARACR for all tests.

INTEGRATED CASE APPLICATION — PINNACLE MANUFACTURING: PART VI

15-35 (Objectives 15-3, 15-5, 15-7) In Part V of the Pinnacle Manufacturing case, you prepared a performance format audit program. In Part VI, sample sizes will be determined by using nonstatistical or attributes sampling, and the results of the tests will

be evaluated. You should use nonstatistical sampling unless your professor tells you to use statistical sampling.

After reviewing the audit program you created in Part V, the audit manager decided to make some modifications. You agreed with her changes. The modified program is included in Figure 15-9.

The audit manager has decided that the tests should be performed for the first 10 months including the month ended 10/31/13. You determine that document numbers are as follows:

Document	First number	Last number
Voucher	6734	33722
Receiving report	9315	23108
Check	12376	37318
Purchase order	3162	17200

Required

a. Using the audit program in Figure 15-9, prepare a nonstatistical sampling data sheet for acquisitions following the format in Figure 15-2 (p. 507). Prepare all parts of the sampling data sheet except those that are blank in Figure 15-2. A formatted sampling data sheet can be downloaded using the Pinnacle link on the textbook Web site. Use the following guidelines:

FIGURE 15-9 Audit Program for Acquisitions and Cash Disbursements

General

1. Discuss the following items with client personnel and observe activities:
   a. Segregation of duties
   b. Use of an adequate chart of accounts
   c. Monthly reconciliation of accounts payable master file with the general ledger
2. Foot acquisitions and cash disbursements journals for a test month and trace postings to the general ledger.
3. Examine file of completed bank reconciliations.
4. Account for a sequence of cancelled checks.
5. Reconcile recorded cash disbursements with cash disbursements on the bank statement for a test month.

Acquisitions

6. Trace entries in the acquisitions journal to related vendors' invoices, receiving reports, and purchase orders.
   a. Examine indication of internal verification of dates, unit costs, prices, extensions and footings, account classifications, recording in the journal, and posting and summarization.
   b. Examine supporting documents for propriety.
   c. Compare prices on vendors' invoices with approved price limits established by management.
   d. Recompute information on vendors' invoices.
   e. Examine vendors' invoices for proper account classification.
   f. Compare dates of recorded acquisitions with dates on receiving reports.
   g. Examine voucher document package for indication of internal verification.
7. Account for a sequence of purchase orders and voucher document packages.
8. Trace a sample of receiving reports to the acquisitions journal.

Cash Disbursements

9. Select a sample of cancelled checks.
   a. Trace cancelled check to the related cash disbursements journal entry and date.
   b. Examine check for signature, proper endorsement, and cancellation by the bank.
   c. Compare date on cancelled check with bank cancellation date.
   d. Recompute cash discounts.

(1) Use only one sampling data sheet.
(2) Select the sampling unit that will permit you to perform the most acquisition audit procedures on the audit program.
(3) Include all audit procedures on the audit program that are consistent with the sampling unit you selected.
(4) Decide EPER, TER, and ARO for each attribute. Consider prior-year results for EPER. (See Figure 10-12 on page 351 in Part III.) Use your judgment for the other two factors.
(5) Decide the sample size for each attribute.

b. Do the same thing for cash disbursements that you did in requirement a for acquisitions. You will not complete the actual results portion of the cash disbursements sampling data sheet.

c. For acquisitions only, use an Excel spreadsheet to select random numbers for the largest sample size in the acquisitions sampling data sheet. Include the numbers in both random order and sorted numbers, from low to high. Document how you selected the numbers.

d. Assume that you performed all audit procedures included in Figure 15-9 using the sample sizes in requirement a(5). The only exceptions found when you performed the tests include the following: two missing indications of internal verification on a vendor's invoice, one acquisition of inventory transaction recorded for $2,000 more than the amount stated on the vendor's invoice (the vendor was also overpaid by $2,000), and two vendors' invoices recorded as acquisitions several days after the receipt of the goods. Complete the sampling data sheet prepared in requirement a. Use Figure 15-4 (p. 513) as a frame of reference for completing the sampling data sheet.

ACL PROBLEM

15-36 (Objective 15-7) This problem requires the use of ACL software, which is included in the CD attached to the text. Information about installing and using ACL and solving this problem can be found in Appendix, pages 850–854. You should read all of the reference material, especially the material on sampling, to answer questions a. through e. For this problem, use the accounts receivable transaction file labeled "Trans" in the "Accounts_Receivable_Audit" subfolder under tables in Sample_Project. Suggested commands, where applicable, are indicated at the end of the problem requirements.

Required

a. Calculate the sample size and sampling interval for a record sample. Use a confidence level of 90%, upper error limit of 6% (tolerable error rate or precision), and expected error rate of zero. (Sampling/Calculate Sample Size; select "Record" radio button.)

b. What is the sample size if you increase the confidence level to 95% and do not change the other sampling parameters? What is the sample size if you increase the upper limit to 8%, with a confidence level of 90% and expected error rate of zero?

c. Select the sample based on the sample size determined in part a. (Sampling /Sample Records; select the "Record" radio button under "Sample type." For "Sample Parameters" select the "Random" radio button and sample size you determined in part a., use a seed of 5.) Save the file using a naming convention such as AR_trans_sample.

d. What is the invoice number of the largest invoice selected for testing? Does your sampling plan consider invoice amount? (Quick Sort)

e. Assume you found one error in the sample. Without using ACL, will your results be acceptable? Explain. Now use ACL to calculate the upper error frequency. (Sampling/Evaluate Error; input the confidence level, sample size, and one error.)

RESEARCH PROBLEM 15-1: SAMPLING FOR SMALL POPULATIONS

Auditors often have to test the effectiveness of infrequently operating controls, such as monthly closing and reconciliation processes. Determining the appropriate extent of testing of such controls presents unique challenges because of the small size of the population. Visit the Web site for *The CPA Journal* (www.cpajournal.com) and use the search function to locate the article "Auditing Internal Controls in Small Populations" by Julian E. Jacoby and Neal B. Hitzig, December 2011.

Required

Based on your reading of the article, answer the following questions.

a. What is the nature of most infrequently operating controls, and why is it important for the auditor to test these controls?

b. What are the factors that the auditor should consider in determining the extent of tests of controls?

c. Why do the authors believe that existing guidance for small populations results in sample sizes that are too small?

d. Explain the sampling approach the authors recommend be used to test small populations. Include comparison of the recommended sample size ranges under this approach to those recommended in the AICPA *Audit Sampling* Audit Guide.