GUIDED WORKBOOK

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ELEMENTARY STATISTICS WITH INTEGRATED REVIEW

TWELFTH EDITION

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Dutchess Community College

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Welcome to statistics! In the corresponding chapter of the Triola text, you will begin the course with an introduction to the basic terminology used in statistics. Most students are not as familiar with statistics as they are with algebra. So, you may not be sure what to expect in this course. We will begin the *Guided Workbook for Elementary Statistics with Integrated Review* with a brief discussion of how statistics is different.

Since you have found your way to the *Guided Workbook with Integrated Review*, let me begin by explaining what this resource is and how you can use it.

This workbook parallels Triola, *Elementary Statistics,* 13th edition. The 10 integrated review chapters correlate with the first 10 chapters in the *Elementary Statistics* textbook. This workbook will review the algebra and arithmetic that you may need for the corresponding chapter in the text. For example, we will review how to evaluate a formula by substituting and simplifying in this workbook, and you will learn the statistical utility of the formula in the text. So, you may want to complete the integrated review for each chapter before beginning your work in the textbook. You may also wish to come back to this resource as you encounter difficulties with the algebraic and arithmetic calculations within the text.

The format of this resource is that of a workbook. The objectives that we will cover in each chapter will be clearly stated at the beginning of each unit. We will review each objective with an explanation or example(s). After each example, a My Turn! Problem will be provided. You will find space to work out these problems directly in the workbook. The answers to the My Turn! problems are located at the end of each chapter before the Practice Problems. The answers to all the Practice Problems are located at the end of the Workbook. In addition, you can find unlimited practice problems that correspond to this integrated review on MyStatLab. The Integrated Review problems on MyStatLab include corresponding help features such as videos, additional examples, and interactive Help Me Solve This experiences.

I hope that you will find this integrated review to be helpful, and I wish you success in this course. Let's start our journey!

Objective 1: Learn how statistics is different.

Most students join a statistics course not exactly sure what they have signed up for. It isn't algebra, is it? It definitely isn't calculus. So, what is it? I highly recommend that you open your textbook (either the paper version or etext) and peruse the chapter titles. You won't see terminology such as *factor* or *solve*. What you will see are such terms as *data*, *summarizing*, *graphing*, *estimating*, *inference*, and *probability*. Statistics involves making decisions based on information. You will learn how to gather, organize, and glean meaning from data. Yes, there will be calculations involved, and these calculations often involve large sets of data. Therefore, much of what you would encounter in statistics would best be handled with appropriate technology.

You may notice that many of the problems in the textbook appear to be "word problems." I find that this often makes students anxious. However, look closer at the problems. You are not going to be solving for x. The application problems that you typically encounter in the textbook are more interesting to read. The words are describing a real-world scenario. That is, they describe where the data came from and even provide the data we are dealing with. You may want to view the problems as a sort of information source from which you need to extract the desired information and numbers, rather like a dictionary or telephone book. (Do those exist anymore?)

Many students find that they enjoy statistics a lot more than a basic algebra class, as it feels more relevant to them. Statistics is everywhere. Once you delve into the course, you will be able to apply what you learn almost immediately.

Objective 2: Construct a plan of action for success.

As much as you may end up loving statistics, you probably want to have to take this course only once. As such, you should form a plan of action so that you succeed.

1. Determine your weaknesses and develop a strategy to overcome each of them.
   If you tend to lose focus or procrastinate, find a study buddy to motivate you.
   If you tend to leave materials for class at home, perhaps you can locate a locker on campus or have a prepacked statistics bag that contains your calculator, pencils, etc.
   If you tend to get anxious during test, find ways to simulate the testing environment as much as possible BEFORE you take a test.
2. Determine at least three ways to get help.
   What are you going to do when you get stuck on a topic? It is best to come up with several ways to get help before you are frazzled.
   Some ideas to consider:
   Watching the videos that accompany this text.
   Going to the math lab (It might be called something different at your college.).
   Visiting your professor during office hours.
3. Use appropriate technology.
   Statisticians use technology in the real world. If your professor allows it and recommends a particular technology tool, make the investment and gain access to it. Get your hands on

the technology as soon as you can. Practice with it. Use the same technology when you practice as you would during testing situations.

4. Determine an appropriate study schedule.
   It is generally recommended that you spend 2–3 hours studying/practicing outside of class for every hour that you spend in class. If you are taking this course online or in hybrid format, you will want to increase this recommended time. If you tend to struggle with math, you will also want to increase this time allotment.
   Also, remember to break the time into manageable pieces. The material will stick with you better in the long term if you look at it every day than if you have a marathon session the night before an exam.

If you need more study tips, there are entire books devoted to success strategies and you may want to consider finding one you like. For now, let's focus on our first objective of the integrated review!

Objective 3: Identify variables in context.

A variable represents an unknown quantity. In statistics, this could be a data value. You may want to consider using a variable name that is helpful in identifying what it represents (e.g., w for weight, h for height).

Note that within this course, you will feel as though you are reading Greek at times because you will be! A lot of Greek letters are used as variables in this course. The good news is that if you ever travel to Greece, you will be able to read some of the signs there. To see some of the Greek alphabet that you may encounter in this course, please see Appendix A.

Example 1 Let n represent the number of respondents to a survey about exercise. What does $n = 50$ mean?

It means that 50 people responded to the survey about exercise.

My Turn!

Let h represent the height of a wave in feet at "Jaws" in Maui. What does $h = 30$ mean?

Example 2 A six-sided die is rolled.

a) Let d represent the side that faces up. What are the possible values for d?
A six sided die has sides with 1, 2, 3, 4, 5, and 6 dots. So, d has the possible values of 1, 2, 3, 4, 5, or 6.

b) Let t represent the sides that face up that are multiples of 3. What are the possible values for t?
The faces of a die that are multiples of 3 are 3 and 6. Therefore, t has the possible values of 3 or 6.

c) Now, the die is rolled 4 times. Let f represent the number of times that the die lands with a 5 facing up. What are the possible values for f?
The die could land on a five 0, 1, 2, 3, or 4 times. So, f has the possible values of 0, 1, 2, 3, and 4.

My Turn!

Let b represent the number of boys in a family of 5. What are the possible values for b?

Objective 4: Recognize and convert between units of measurement

Since statistics deals with measurements, you should feel comfortable recognizing both metric and English units of measurement along with their abbreviations.

The metric system uses the following basic prefixes.

Prefix	Meaning
kilo	1000
hecto	100
deca	10
deci	0.1
centi	0.01
milli	0.001

The following are some common units of measurement in the metric system along with their abbreviations.

Metric	
Unit of Measurement	Abbreviation
gram	g
meter	m
liter	l

The following are some common units of measurement in the English system.

English	
Unit of Measurement	Abbreviation
foot	ft.
mile	mi.
ounce	oz.
inch	in.
pound	lb.

The above tables are not comprehensive lists, and if you are unfamiliar with a unit of measurement, you may want to look it up in one of our more comprehensive tables in Appendix B.

Occasionally, you may have to convert your data from one unit of measurement to another unit of measurement for the sake of consistency. That is, you generally want your data to be in the same unit of measurement before you perform any further calculations.

Here are a few of the most commonly used conversions.

12 inches = 1 foot
5280 feet = 1 mile
1 meter $\approx$ 3.28 feet
1 kilogram $\approx$ 2.2 pounds
1 mile $\approx$ 1.62 kilometers

Additional commonly used conversions can be found in Appendix C.

Example 3 Convert 72 inches to feet.

We will use the conversion factor that there are 12 inches in 1 foot. We write this as a fraction and multiply by it. We can do this, since the numerator is equal to the denominator; so, we are essentially multiplying by 1.

$$72 \text{ } \cancel{\text{inches}} \times \frac{1 \text{ foot}}{12 \text{ } \cancel{\text{inches}}} = 6 \text{ feet}$$

Answer 6 feet

My Turn!

Convert 5 miles to feet.

Example 4 Convert 8960 meters to kilometers.

There are 1000 meters in 1 kilometer.

$$8960 \text{ meters} \times \frac{1 \text{ kilometer}}{1000 \text{ meters}} = 8.960 \text{ kilometers}$$

Answer 8.96 kilometers

My Turn!

Convert 56 grams to milligrams.

Objective 5: Classify data as a type of number.

You will encounter several classifications for data in the text. Although we will not go over those here, we will indirectly practice classifying, using some concepts you probably know from prerequisite material.

Example 5 Select which of the following types of numbers the number 6 belongs to.

Whole numbers, integers, real numbers

Whole numbers = {0, 1, 2, 3, 4, ...}

Integers = {..., −3, −2, −1, 0, 1, 2, 3,...}

Real numbers = all the numbers on a number line; this includes rational and irrational numbers.

The number 6 belongs to each of these sets of numbers.

My Turn!

Select which of the following types of numbers the number 2.5 belongs to.

Whole numbers, integers, real numbers

Objective 6: Evaluate exponents.

Recall that exponents are shorthand for repeated multiplication. The value of the exponent tells you how many times the factor repeats.

For instance, $3^4 = 3 \cdot 3 \cdot 3 \cdot 3$.

Example 6 Evaluate 8^3.

We expand 8^3, and then calculate the repeated multiplication. Most technology can calculate exponents, and you may want to explore how to do this on your calculator now.

$$8^3 = 8 \cdot 8 \cdot 8 = 512$$

Answer 512

My Turn!

Evaluate 7^4.

Objective 7: Translate numbers between scientific notation and standard form and vice versa.

Scientific notation is a version of shorthand for very large or very small numbers.

A number is in **scientific notation** when it is written in the form $a \times 10^b$, where a is a number greater than or equal to 1 and less than 10.

Example 7 Translate 0.000478 to scientific notation.

We have to move the decimal point until there is one digit to the left of it. (This is how you make a into a value greater than or equal to 1 and less than 10.) This would move the digit immediately to the right of 4. Count the number of places that we moved the decimal point and note the direction we moved it. We moved the decimal point 4 places to the right. Since we moved it to the right, the exponent on the 10 will be negative.

$$0.000478 = 4.78 \times 10^{-4}$$

Answer 4.78×10^{-4}

My Turn!

Write 0.0392 in scientific notation.

Example 8 Translate 760,000 to scientific notation.

For scientific notation, we have to move the decimal point until there is one digit to the left of it. This would move the digit immediately to the right of 7. Count the number of places that we moved the decimal. We moved the decimal 5 places to the left. Since we moved it to the left, the exponent on the 10 will be positive.

$$760,000 = 7.6 \times 10^5$$

Answer 7.6×10^5

My Turn!

Write 9,670,000 in scientific notation.

Example 9 Write 3.79×10^3 in standard form.

To translate from scientific notation to standard form, we are essentially doing the reverse of the above examples. Whenever the exponent is positive, we will move the decimal point to the right. Since the exponent in this example is positive 3, the decimal point will move right three places. (This is because we are multiplying by 1000.)

$3.79 \times 10^3 = 3790$

Answer 3790

My Turn!

Write 8.1×10^{-7} in standard form.

Objective 8: Identify the number of significant digits

The **significant digits** (or **significant figures)** of a number are the digits that carry meaning.

The following are considered significant digits:

1. All nonzero digits are significant
2. Zeros between nonzero digits are significant.
3. Leading zeros are never significant.
4. In a number with a decimal point, trailing zeros, those to the right of the last non-zero digit, are significant (they indicate that the number represents something that was measured to that level of precision).
5. In a number without a decimal point, trailing zeros may or may not be significant, and more information is needed to make that determination. (For purposes of our text, we will assume that they are not significant unless otherwise stated.)

Example 10 Identify the number of significant digits in the following numbers.

a) 938,000
9, 3, and 8 are each significant digits, since they are nonzero digits. The trailing zeros will be considered as insignificant for purposes of this text.
There are 3 significant figures.

b) 0.00012
The leading zeros are insignificant. The 1 and 2 are significant digits. So, there are 2 significant digits.

c) 0.000103
The leading zeros are insignificant. The 1 is significant. The 0 to the right of the 1 is significant, since zeros between nonzero digits are always significant. The 3 is significant, since it is a nonzero digit. So, there are 3 significant digits.

My Turn!

Identify the number of significant digits in the following numbers.

a) 1,030,000
b) 101
c) 0.000002

Objective 9: Interpret technology output that is in scientific notation.

Depending on the technology that you use, you may encounter scientific notation that looks slightly different on your screen than how we have been writing it thus far. You will want to try calculating something like 2^{50} using technology. The result is probably too large to write in standard form on your screen. On a TI-84 calculator, it may show up as 1.125899907E15. This output indicates that the number has been expressed in scientific notation. That is,1.125899907E15 is equivalent to $1.125899907 \times 10^{15}$.

Example 11 Round 2.058911321E14 (which is 3^{30}) to 3 significant digits.

2.058911321E14 is equivalent to $2.058911321 \times 10^{14}$.

If we round to 3 significant digits, we begin looking at the digits from left to right. The 2 is significant since it all nonzero digits are significant. The 0 is significant, since it is between two nonzero digits. The 5 is significant, since it is nonzero. This would be our 3 significant digit positions. However, for the 5 we have to decide whether to keep it or to round up. Since the digit immediately to the right of it is an 8, we round the 5 up to a 6.

So, our rounded value is 2.06×10^{14}.

Answer 2.06×10^{14}

My Turn!

The Excel output for 4^{30} is 1.15292E+18. Round this number to 3 significant digits.

Answers to My Turn!

1. A wave that is 30 feet high at "Jaws"
2. The possible values for b are 0, 1, 2, 3, 4, and 5.
3. 26,400 feet
4. 56,000 mg
5. Real numbers
6. 2401
7. 3.92×10^{-2}
8. 9.67×10^{6}
9. 0.00000081
10. a) 3 significant digits b) 3 significant digits c) 1 significant digit
11. 1.15×10^{18}

Practice Problems

1. Let d represent the days since a baby was born. If a baby was born on January 3 and today is January 15, what does d equal?
2. If t represents the time in years since the last U.S. presidential election, what are the possible values for t?
3. Convert 5 meters to feet.
4. Convert 35 kilometers to meters.
5. Select which of the following types of numbers the number -4 belongs to: whole numbers, integers, real numbers.
6. Evaluate 9^3.
7. Write 0.000706 in scientific notation.
8. Write 270,000 in scientific notation.
9. Write 9.71×10^{7} in standard form.
10. Identify the number of significant digits in the following numbers.

a) 503,000.2
b) 909
c) 3000

11. Excel output for $\frac{1}{4^{30}}$ is 8.67362E-19. Round this number to 3 significant digits.