APPENDIX A

Getting Started

Summary

This appendix is a quick introduction to some of the skills you will need to succeed in a college level statistics course. You should read Appendix A in the text and if you feel comfortable that you possess those skills, then proceed on to Chapter 1. If you find that there is something in Appendix A that you need to review or that you never learned, then follow up by working the problems on the book's website, exploringstatistics.com under the heading *free materials*. If you find that you need even a little more help, this study guide section for Appendix A should help.

To succeed in a college statistics course you should be able to a) perform basic arithmetic, b) understand the meaning of and work with fractions, c) simplify basic algebraic equations, d) read graphs, e) know the order of operations necessary to reduce complex expressions to one number, f) understand a logical progression, and g) be willing to learn.

Sometimes symbols are confusing in statistics. Remember they are just simplified names for things. So for instance, in this course, you will frequently use the mean (the arithmetic average). You will also learn that the symbol for the mean when it is calculated on data from a sample is a capital *X* with a bar over it. Like this: $\bar{X}$. And the symbol for the mean when it is calculated on data from a population is a Greek letter μ. We hope you see from this example how symbols are just a shortcut to convey a lot of information. Be sure to memorize these symbols as they come up in the course. This will help a lot. One detail about symbols that can cause students trouble if not understood is that the subscript of a symbol just gives information about what the symbol refers to. So for instance, if you calculate the mean number of times a group of monkeys make vocalizations while eating and you compare that to the mean number of times a group of dogs make vocalizations while eating you might use these two symbols $\bar{X}_{monkeys}$ and $\bar{X}_{dogs}$ or you might just see $\bar{X}_1$ and $\bar{X}_2$ to represent the two groups. The key is not to mistakenly think that the subscript means to *do* something mathematically, it is just a label. It gets more complicated when there are subscripts and superscripts, like this $\bar{X}_2^{\,2}$, just remember the superscript *does* tell you something mathematical to do, in this case it means square; and the subscript just tells you which group, so this symbol means that you are squaring the mean of group two.

There are at least two approaches to rounding. Most behavioral statisticians use a technique that instructs you to look at the number to the left of the last number you want to keep. If that number is five or greater increase the last number you want to keep by one and drop all the rest (e.g., you want to round 1.23654567 to two decimals. The 3 in the hundredths place is the last number you want to keep. The number to the left of it is 6, which is 5 or greater, so you change the 3 to a 4 and drop all the rest of the numbers leaving you with 1.24). If the number to the left of the last one you want to keep is less than 5 then just drop all the numbers you don't want (e.g., you want to round 1.13458567 to two decimals. The 3 is the last number you want to keep. The number to the left of it is 4, which is less than 5, so you just drop all the rest of the numbers up to the 3: 1.23). When deciding how many places to round to, it is best to find out the preference of your instructor when you are taking a class, when you are out in the world doing statistics on your own, you will follow the conventions used in the field you are working in or the journal you are writing for. Many behavioral statisticians will round to three decimals as they work a problem and then express their final answer to two decimals. There are some exceptions to this, but you will learn those as you move through the course. In the answers to the problems throughout this study guide, we will use the technique described above, rounding to three decimals when working the problem and then expressing the answer in two decimals, except for the exceptions that you will learn.

Order of operations: First, do what is in parentheses, then brackets (if there are any). Square numbers first, then multiply and divide (in order, from left to right), then add and subtract. Work the numerator of a complex expression by itself and the denominator by itself. If there is a square root sign over a complex expression do what is under that sign first and take the square root last.

Multiple-Choice Questions

1. The numerator of a fraction is the _____.
a. top;
b. bottom;
c. outcome*;*
d. sum.

2. In this fraction: $\frac{503}{18}$, the denominator is _____.

a. 503;
b. 18;
c. 27.94*;*
d. 27.

3. To simplify this fraction: $\frac{503}{18}$

a. Divide 503 by 18;
b. Divide 18 by 503;
c. This fraction is simplified*;*
d. Multiply 18 by 503.

4. Simplify this fraction: $\frac{503}{18}$

a. 503;
b. 18;
c. 27.94*;*
d. 27.

5. Round this number to the nearest whole number: 6.7898.

a. 6;
b. 7;
c. 7.00*;*
d. 7.01.

6. Round this number to two decimal places: 6.7898.

a. 6.78;
b. 6.79;
c. 7.00*;*
d. 7.01.

7. Round this number to three decimal places: 6.7898.

a. 6.79;
b. 6.789;
c. 6.790*;*
d. 7.000.

8. Given this mathematical expression: $\sum fX^2$, what should you do first?

a. Square the *X*s;
b. Multiply *f* by *X*;
c. Add the *f*s*;*
d. Add the *X*s.

9. Given this mathematical expression: $\frac{(\sum X)^2}{N}$, what should you do first?

a. Square the *X*s;
b. Divide by *N*;
c. Add the *X*s*;*
d. Multiply Σ by *X*.

Problems
(Round all answers to two decimal places.)

1. $\frac{8+1+4+6}{3}$

2. $\frac{(10-6-5+2)^2+(6-3-4+4)^2}{4(5+3)}$

3. $\frac{\left(66-\frac{12^2}{10}\right)+\left(75-\frac{8^2}{5}\right)}{10-1}$

4. $\frac{(5)(20)-(15)(6)}{\sqrt{[(5)(38)-(150)][(5)(22)-(93)]}}$

5. $\frac{\frac{225}{9}-(12)(6)}{(8.5)(6.3)}$

6. $36 - (1.96)\left(\frac{2}{\sqrt{100}}\right)$

7. $\frac{5.6-12.4}{\sqrt{\left(\frac{32+41}{5+6-2}\right)\left(\frac{1}{6}+\frac{1}{3}\right)}}$

8. $\sqrt{\frac{21-\frac{(-8)^2}{6}}{6}}$

9. $\sqrt{\frac{\left[68-\frac{(5)^2}{2}+54-\frac{(11)^2}{5}\right]}{6(8-1)}}$

10. $\frac{\left(\frac{112}{8}-\frac{73+84}{8+8}\right)^2}{\frac{13.26}{8}+\frac{13.26}{8+8}}$

11. Solve for *x*. $\frac{x+5}{3} = 4.25$

12. Solve for *x*. $\frac{24-4}{x} = 6.42$

13. Solve for *x*. $\frac{15-7}{4} = 2x - 2$

14. Solve for *x*. $\frac{12-3}{3} = \frac{3x+5}{2}$

ANSWERS

Multiple-Choice Questions

1. a
   Explanation: The top of a fraction is called the numerator and the bottom of a fraction is called the denominator.
2. b
   Explanation: Remember the denominator is the bottom part of a fraction.
3. a
4. c
5. b
   Explanation: Look at the last number you want to keep. Here that is the 6. The number to the left of it is greater than 5 so increase the 6 by 1 and drop all the numbers to the left of it. Even though 7.00 is the same as 7, generally, when you are rounding to a whole number you should express the outcome as a whole number. If you were to list the two decimals, you imply (incorrectly in this case) that you rounded to two decimals, which you did not.
6. b
   Explanation: Look at the last number you want to keep. Here, that is the 8. The number to the left of it is greater than 5 so increase the 8 by 1 and drop all the numbers to the left of it.
7. c
   Explanation: This one is a little harder than the others because you're increasing the 9 to a 10, which really means you change the nine to a 0 and carry the 1 over to the next column. Here it might be easier, if you're having trouble, to imagine increasing 89 by 1, which increases to 90.
8. a
   Explanation: Remember, first do whatever is in parentheses, then the superscripts, then multiply, then add.
9. a
   Explanation: To get it right, you have to remember first to do whatever is in parentheses and you also need to remember that Σ means to sum something (here a set of *X*s).

Problems

(Round all answers to two decimal places.)

1. $\frac{8+1+4+6}{3} = \frac{19}{3} = 6.33$

2. $\frac{(10-6-5+2)^2+(6-3-4+4)^2}{4(5+3)} = \frac{(1)^2+(3)^2}{4(8)} = \frac{1+9}{32} = \frac{10}{32} = 0.31$

3. $\frac{\left(66-\frac{12^2}{10}\right)+\left(75-\frac{8^2}{5}\right)}{10-1} = \frac{\left(66-\frac{144}{10}\right)+\left(75-\frac{64}{5}\right)}{9}$

   $= \frac{(66-14.4)+(75-12.8)}{9} = \frac{51.6+62.2}{9} = \frac{113.8}{9} = 12.64$

4. $\frac{(5)(20)-(15)(6)}{\sqrt{[(5)(38)-(150)][(5)(22)-(93)]}} = \frac{100-90}{\sqrt{[190-150][110-93]}}$

   $= \frac{10}{\sqrt{[40][17]}} = \frac{10}{\sqrt{680}} = \frac{10}{26.077} = 0.38$

5. $\frac{\frac{225}{9}-(12)(6)}{(8.5)(6.3)} = \frac{25-72}{53.55} = \frac{-47}{53.55} = -0.88$

6. $36 - (1.96)\left(\frac{2}{\sqrt{100}}\right) = 36 - (1.96)\left(\frac{2}{10}\right)$

$= 36 - (1.96)(.2) = 36 - .392 = 35.61$

7. $\frac{5.6-12.4}{\sqrt{\left(\frac{32+41}{5+6-2}\right)\left(\frac{1}{6}+\frac{1}{3}\right)}} = \frac{-6.8}{\sqrt{\left(\frac{73}{9}\right)(.167+.333)}} = \frac{-6.8}{\sqrt{(8.111)(.5)}}$

$= \frac{-6.8}{\sqrt{4.056}} = \frac{-6.8}{2.014} = -3.38$

8. $\sqrt{\frac{21-\frac{64}{6}}{6}} = \sqrt{\frac{21-10.667}{6}} = \sqrt{\frac{10.333}{6}} = \sqrt{1.722} = 1.31$

9. $\sqrt{\frac{\left[68-\frac{(5)^2}{2}+54-\frac{(11)^2}{5}\right]}{6(8-1)}} = \sqrt{\frac{\left[68-\frac{25}{2}+54-\frac{121}{5}\right]}{6(7)}} = \sqrt{\frac{[68-12.5+54-24.2]}{42}}$

$= \sqrt{\frac{85.3}{42}} = \sqrt{2.031} = 1.43$

10. $\frac{\left(\frac{112}{8}-\frac{73+84}{8+8}\right)^2}{\frac{13.26}{8}+\frac{13.26}{8+8}} = \frac{\left(14-\frac{157}{16}\right)^2}{1.658+\frac{13.26}{16}} = \frac{(14-9.813)^2}{1.658+.829}$

$= \frac{(4.187)^2}{2.487} = \frac{17.531}{2.487} = 7.05$

11. $\frac{x+5}{3} = 4.25$

Multiply both sides by 3.
$x + 5 = 12.75$

Subtract 5 from both sides.
$x = 7.75$

12. $\frac{24-4}{x} = 6.42$

First, reduce what you can by solving 24-4.
$\frac{20}{x} = 6.42$

Multiply both sides by *x*.
$20 = 6.42x$

Divide both sides by 6.42.
$x = 3.12$

13. $\frac{15-7}{4} = 2x - 2$

$\frac{8}{4} = 2x - 2$

First, reduce what you can by solving the left side of the equation.
$2 = 2x - 2$

Add 2 to both sides.
$4 = 2x$

Divide both sides by 2.
$2 = x$

14. $\frac{12-3}{3} = \frac{3x+5}{2}$

$\frac{9}{3} = \frac{3x+5}{2}$

First, reduce what you can by solving the left side of the equation.
$3 = \frac{3x+5}{2}$

Multiply both sides by 2.
$6 = 3x + 5$

Subtract 5 from both sides.
$1 = 3x$

Divide both sides by 3.
$0.33 = x$