Skills Needed for Success in Applied Statistics

Students are often concerned about whether or not they have the mathematical skills needed to succeed in a course. The purpose of this document is to help identify some of those skills that you should already possess so that you can be successful in Math 113, Introduction to Applied Statistics.

If you find that you are weak in some of these areas, then get help. Visit the Student Learning Center and let them know you need help reviewing arithmetic and algebra skills for statistics (if you just tell them you're in statistics, they may have trouble finding someone to help), watch some of the videos in the LRC, or see the instructor.

Rounding

Here are some guidelines for rounding numbers.

- When rounding to a certain number of decimal places, use the next digit to determine whether to round up or not. If the next digit is a 5 or larger, then round your digit up. If the next digit is a 4 or lower, then leave your digit as it is.
- Always carry more decimal places through the intermediate steps than you plan to give in the final answer. If you want 2 decimals in the final answer then you should carry at least 3 (preferably more) places until you get to the final answer.
- A general rounding rule is to round the final answer to have one more decimal place than the original values. It is better to give more decimal places than needed than not enough.
- A general rounding rule for proportions is three decimal places, but I like four and if the problem comes out exactly with 6, it's better to go ahead and give all six.
- Don't be stingy. 2/3 is not 0.67, either put it in the calculator as 2/3 or 0.66666666 (a whole lot of sixes). Those few decimal places can cause rounding errors later.
- If a value can not be displayed exactly, the calculator rounds the value when it displays it to you. 2/3 shows up as 0.6666666667, even though you know the 6 is supposed to repeat forever. The calculator can't show repeating decimals, so it rounds the last digit before displaying it.

Percent, Decimal, and Fraction forms

Much of the time, the information we receive will be given as a percentage. Percentages are easier for most people to comprehend because we use them in real life. But when we perform calculations, we work with decimals or fractions. Fractions are preferred in many cases, since they are exact, but decimals are easier for people to work with on a calculator. Regardless, we do not work with numbers in percent form; in fact, most calculators do not even have a percent key anymore. You will need to know how to convert between the different forms.

Percent means "per hundred" so you can think of the percent symbol as meaning "divided by 100." That is how you convert from a percent to a decimal, you simply divide by 100. A shortcut way of doing that is to move the decimal point two places to the left. To convert from a decimal to a percent involves multiplying by 100 or moving the decimal place two places to the right.

Fractions are easy to convert into decimals with a calculator. You just divide the number on top by the number on bottom. If the decimal repeats, you may put a line over the repeating part of the decimal. For example, the calculator says that 27/110 is 0.2454545455, but that last digit is a rounding issue, it is exactly $0.2\overline{45}$.

Completing Tables

Several of the statistical formulas involve performing calculations on a series of numbers. It is often convenient to arrange these problems in table form.

In this table the first two rows would be given and you would be asked to find the last two rows. The *xy* means multiply the *x* and *y* values together. The x^2y means to square the *x* value and then multiply it by the *y* value.

						Total
x	-3	-1	0	2	4	2
y	0.1	0.2	0.1	0.2	0.4	1.0
xy	-0.3	-0.2	0.0	0.4	1.6	1.5
x^2y	0.9	0.2	0.0	0.8	6.4	8.3

When you see formulas involving *x* or *y*, it usually means apply that formula to every value you have. For example, $x-2$ would mean subtract two from every value, $3x$ means multiply every value by 3, $2(x+7)$ means add 7 to every value and then multiply by 2, and x^2 means square every value.

Function Notation

In your algebra courses, you encountered function notation like $f(x)=3x+2$. We will introduce statistical functions in this course that will have names like $mean(x)$ or $SE(\overline{x})$ or $p(x)$. It is important to realize that this is function notation and not a product. That is, $SE(\overline{x})$ means the Standard Error of $\overline{x}$ not SE times $\overline{x}$. The $SE(\overline{x})$

is to be treated as a single quantity in formulas. In the expression $\frac{\overline{x}}{SE(\overline{x})}$, you can not cancel out the $\overline{x}$ and get $\frac{1}{SE}$.

Solving Equations

There is an algebra prerequisite for this course. You will need to know how to solve equations. In most cases, you will be able to substitute in the values and then solve, although you are certainly welcome to solve and then substitute in the values. If you substitute and then solve, be careful about rounding too much in the intermediate steps. These problems are of the type and difficulty that you'll need to solve in this course. In each case, round your answers to two decimal places. The answers are given at the right so you can see if you're doing them correctly.

Use the formula $z = \frac{x - \mu}{\sigma}$ to find the following.

1. Find z if $x = 80$, $\mu = 60$, and $\sigma = 15$. $z = 1.33$
2. Find x if $z = 1.96$, $\mu = 18.4$, and $\sigma = 3.2$ $x = 24.67$
3. Find σ if $z = -2.05$, $x = 8.3$, $\mu = 10.4$ $\sigma = 1.02$
4. Find μ if $z = -1.28$, $x = 14.2$, and $\sigma = 5.6$ $\mu = 21.37$

Use the formula $\sigma^2 = \sum x^2 p(x) - \mu^2$ to find the following.

5. Find σ^2 if $\sum x^2 p(x) = 18$ and $\mu = 4$. $\sigma^2 = 2$
6. Find σ if $\sum x^2 p(x) = 32.4$ and $\mu = 5.1$. $\sigma = \sqrt{6.39} \approx 2.53$
7. Find $\sum x^2 p(x)$ if $\sigma = 8.2$ and $\mu = 12.3$. $\sum x^2 p(x) = 218.53$

Use the formula $t = \frac{b_1}{SE(b_1)}$ to find the following.

8. Find b_1 if $t = -2.1$ and $SE(b_1) = 1.6$ $b_1 = -3.36$
9. Find $SE(b_1)$ if $t = 4.6$ and $b_1 = 5.2$ $SE(b_1) = 1.13$

Combining Formulas

Sometimes it will be necessary to combine two or more formulas together to find a value. Be sure that you don't round the intermediate values too much when you're doing this or it can lead to wrong answers at the end.

Use the formulas $ME = t \times SE$ and $SE = s/\sqrt{n}$ to find the following.

10. Find ME if $s = 4.7$, $n = 15$, and $t = 2.145$.
    a. The first step is to find $SE = 4.7/\sqrt{15} \approx 1.2135$.
    b. Now find $ME = 2.145 \times 1.2135 \approx 2.603$. We can round the final answer.
11. Find s if $n = 24$, $t = 2.069$, and $ME = 5.61$
    a. The first step is to find SE. $5.61 = 2.069 \times SE$ gives $SE \approx 2.7115$.
    b. Now use that to find s. $2.7115 = s/\sqrt{24}$ gives $s \approx 13.28$.

Finding the Equation of a Line

You will be need to know how to take a point and a slope and find the equation of a line.

Most of you will probably work with the slope-intercept form of a line, $y = mx + b$, where *m* is the slope and *b* is the *y*-intercept. There are other forms of a line available, but this one is sufficient for our needs.

Find the equation of the line passing through the point (3,5) having a slope of 2.6.
The first step is to find the *y*-intercept by plugging the values we know into the equation. The *x* and *y* represent any point on the line, and (3,5) is one of those. $5 = 2.6(3) + b$.
Now solve that for the *y*-intercept to find $b = -2.8$. Finally, rewrite the equation, replacing the slope and *y*-intercept by their values. $y = 2.6x - 2.8$.

Reading Comprehension

You need to be able to read, comprehend, and follow instructions. Do not jump straight to the problem without reading the instructions. Often times students will come up during a test and ask how many decimal places I want and I will point at the instructions to the problem that say "Leave answers as fractions" or "Give answers with four decimal places." Other times, the instructions might say something like "Set up the problem, but do not solve it," which could obviously save you a lot of time.

This is an applied statistics course, which means that many of the problems we encounter will be given in story form, rather than what you see in this sheet. You need to be able to read through the problem, determine what is being asked for, what you know, and then apply the mathematical skills to find the values.