Significant Figures

MATH-252-01: Probability and Statistics II*

Spring 2018

At various points in the quizzes and exams for this course, you'll need to provide a numerical answer that may be obtained with a calculator. Sometimes the answer can be written as an exact decimal, like 25.3, but sometimes it will be something more complicated like $\frac{1}{3} = .33333333\ldots$ or $\sqrt{2} = 1.4142135\ldots$. On each quiz or exam you'll be asked to write your answers exactly or to some number of significant figures, typically three or four. This note is to spell out what's meant by significant figures in case you're not familiar with them, or as a reminder in case you are.

The number of significant figures in an approximate expression is the number of digits that carry information about the number. For example, 4.35 has three significant figures, and can represent any number which rounds to 4.35, i.e., any number between 4.345 and 4.355.

Some finer points:

- "Leading zeros" **do not** count as significant figures, e.g., .0343 only contains three significant figures, not four.
- "Trailing zeros" in a number with a decimal point **do** count, e.g., 1.230 is written to four significant figures.
- You should keep at least two more significant figures in intermediate steps than are required in the answer. E.g., if you need $x + y$ to three significant figures, and you first need to calculate x and y, don't round them off to fewer than five significant figures before you add them, or you may introduce roundoff error. (E.g., if your calculator tells you $x = 2.3174252\ldots$ and $y = 4.1260193\ldots$, then $x+y = 6.4434445\ldots$, which is 6.44, written to three significant figures. But if you round x and y to three significant figures before adding them, you'll get $4.13+2.32 = 6.45$. However, keeping a couple of extra decimal places gives you $4.1260 + 2.3174 = 6.4434$ which rounds correctly to 6.44. (Of course, it's always safe to keep more significant figures in intermediate steps.) Note that if you need to use the result of part (a) in part (b), you should write the result rounded to the correct number of significant figures in the answer box for part (a), but use the un-rounded version in doing the calculation for part (b).
- If the result is exact, you may write it to any number of significant figures, as long as you're not rounding it off. For instance, if the answer is 13, and the instructions say to write answers exactly or to three significant figures, it's okay to write 13 rather than 13.0.
- You should *not* in general leave your final answer as a fraction like $\frac{1}{6}$ or use notation like $.1\overline{66}$. These will not receive full credit.

Some examples of numbers written to three significant figures are 32.8, 3.28, .328, .0328, .00328, 41.0, 4.10, .410, .0410.