Guidelines for Lab Reports

(with examples from the Probability and Geometric Series Lab)

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1. Your report should be organized in the same way the lab is organized. In particular you should use the numbering and lettering in the lab manual (similar to what you would do in an outline), so the grader can tell which questions you are answering. For example, for your write-up for Part I you could use the following format:

> *<u>Part I</u>*
> *(a) Because four of the six outcomes would end the game, P(X* $= 1) = \frac{4}{6} = \frac{2}{3}$.
>
> *(b) To get* $X = 2$ *you have to roll either …*
>
> *(c) To determine a formula for P(X = n) we computed P(X = 3) and P(X = 4) so we could establish a pattern. We show below …*

2. You should describe what you are doing when you show mathematical expressions, and you should explain nontrivial mathematical steps. Use complete sentences when you give these descriptions and explanations. State clearly the meaning of all variables and functions you introduce. Show all significant mathematics, but do not show the details of trivial arithmetic. Unless somehow it has affected your results (e.g., round-off error or misleading graphs), you should not mention the calculator and certainly not keystrokes.

For example, you could give your response to (h) in Part I as follows:

In the last step we derived a formula for the sum, S_N*, of the first N terms of a geometric sum. To test our formula we used it compute the geometric sum which we have already computed without the formula. In step (e) we computed* $\mathbb{E}(Z_8)$ *term-by-term. Now we use the results from steps (f) and (g) to compute* $\mathbb{E}(Z_8)$ *:*

$$\mathbb{E}(Z_8) = \tfrac{4}{3}[1 + \tfrac{2}{3} + \left(\tfrac{2}{3}\right)^2 + \left(\tfrac{2}{3}\right)^3 + \left(\tfrac{2}{3}\right)^4 + \left(\tfrac{2}{3}\right)^5 + \left(\tfrac{2}{3}\right)^6 + \left(\tfrac{2}{3}\right)^7]$$

$$= \tfrac{4}{3}\left[\frac{1-\left(\frac{2}{3}\right)^8}{1-\frac{2}{3}}\right] \approx 3.84 \text{ , rounded to two decimal places.}$$

The result is the same as the one we computed in step (e).

Here's an example of a response which is insufficient:

We computed the value of $\mathbb{E}(Z_8)$ *and got 3.84*

Here's an excerpt from a response which is so detailed it distracts the reader from the important ideas.

… we computed (1 $- (2 \div 3)$*^8) on the calculator. Then we multiplied that result by 4 and got 3.843926231.*

3. Passive voice should be avoided. Oops. **You** should avoid passive voice. Here's an example of poor wording in a math report:

The value of $\mathbb{E}(Z)$ *was found to be* $\ldots$.

Even though passive voice has its place in our language, you should avoid it in a mathematical or scientific report. Here's a better way to start that previous sentence:

Our team computed the value of $\mathbb{E}(Z)$ *by* $\ldots$

4. Maybe you are wondering, *do we have to type the report*? No, you don't. You are welcome to submit a handwritten report, but please choose a person with good handwriting for that job. In particular, your scribe should have much better handwriting than your teacher does.

5. Use standard mathematical expressions. The expression (2/3)^5 is poorly written. The proper notation is the following: $\left(\frac{2}{3}\right)^5$. A handwritten $\left(\frac{2}{3}\right)^5$ is better than a typed (2/3)^5.

6. When you use mathematical notation, be sure you use it correctly—especially in cases where two different sets of symbols look similar. For example, in first-semester calculus you saw that $\int\limits_a^b f(t)\,dt$ and $\int f(t)\,dt$ have very different meanings. In the Probability and Geometric Series Lab you should have noticed that $1 + \frac{1}{2} + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + \ldots \left(\frac{1}{2}\right)^{N\text{-}1}$ and $1 + \frac{1}{2} + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + \ldots$ also have very different meanings.

In particular note that

$$1 + \tfrac{1}{2} + \left(\tfrac{1}{2}\right)^2 + \left(\tfrac{1}{2}\right)^3 + \ldots \left(\tfrac{1}{2}\right)^{N-1} = \frac{1-\left(\frac{1}{2}\right)^N}{1-\frac{1}{2}} = 2\left(1 - \left(\tfrac{1}{2}\right)^N\right)$$

whereas

$$1 + \tfrac{1}{2} + \left(\tfrac{1}{2}\right)^2 + \left(\tfrac{1}{2}\right)^3 + \ldots = \frac{1}{1-\frac{1}{2}} = 2$$

7. Be consistent with your variables. For example, a reader would not normally assume that $n = N$. In mathematics Capitalization matters At least As much as It does In english Class. If you need both n and N, then use both, but be aware that *The Reader* will assume they are different symbols with different meanings. In fact you have seen in this lab cases in which n, N, x, and X all have different meanings.

8. When your results or arguments [in future labs] involve a graph, then you should include the graph in your report. You may copy a graph from the calculator screen by hand— just do so carefully. You can also use a computer with a calculator link to print a copy of your calculator's screen. The computers in the help room and outside your teacher's office (123 Physics) have such links. Be sure to add (by hand) the scales and labels for the axes. And when you do insert graphs or images into your reports, label them, make clear references to them, and put them where *The Reader* can find them easily.

9. As you should do in all your written work, avoid ambiguous referents. In math papers this mistake often appears in a sentence which begins, “This means $\ldots$.”