**CP1**

**Python Refresher**

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# CP1

## Python Refresher

This computational activity is refresher on some of the tools we will be using for the practical component of the course as well as an introduction to a few new features. The following are the results of two tasks involving statistical analysis with the Python packages SciPy (Seabold & Perktold, 2010) and NumPy (Harris et al., 2020) with plotting done using Matplotlib (Hunter, 2007).

## Task 1

### 1a) Methods for Finding the Mean and Variance

The SciPy and NumPy functions for the mean and variance likely use the same sample mean and sample variance formulas we used for our manual calculations. Hence, we reached the same answers, essentially by correcting for the bias in the variance estimator of the population mean using Bessel's correction.

### 1b-c) Measurement Result

Using a type B uncertainty analysis, we measured $x$ to be $40.08 \pm 0.25$ with a coverage probability of 68%. This means that our best estimate of the measurand is $40.08$. And, because we observed scatter in the observations, we assumed the observations are theoretically sampled from a gaussian distribution thus, we expect a 68% chance that the measurand is covered within a region outlined by one standard deviation from the mean. (Learning et al., 2002)

## Task 2

### 2a) Unweighted Linear Regression

Figure 1 captures the regression data given to us in the activity sheet. We performed an unweighted linear regression on the three data points and obtained results for the slope and intercept. We found that $m = 3.93 \pm 0.82$ and $c = 6.0 \pm 2.0$

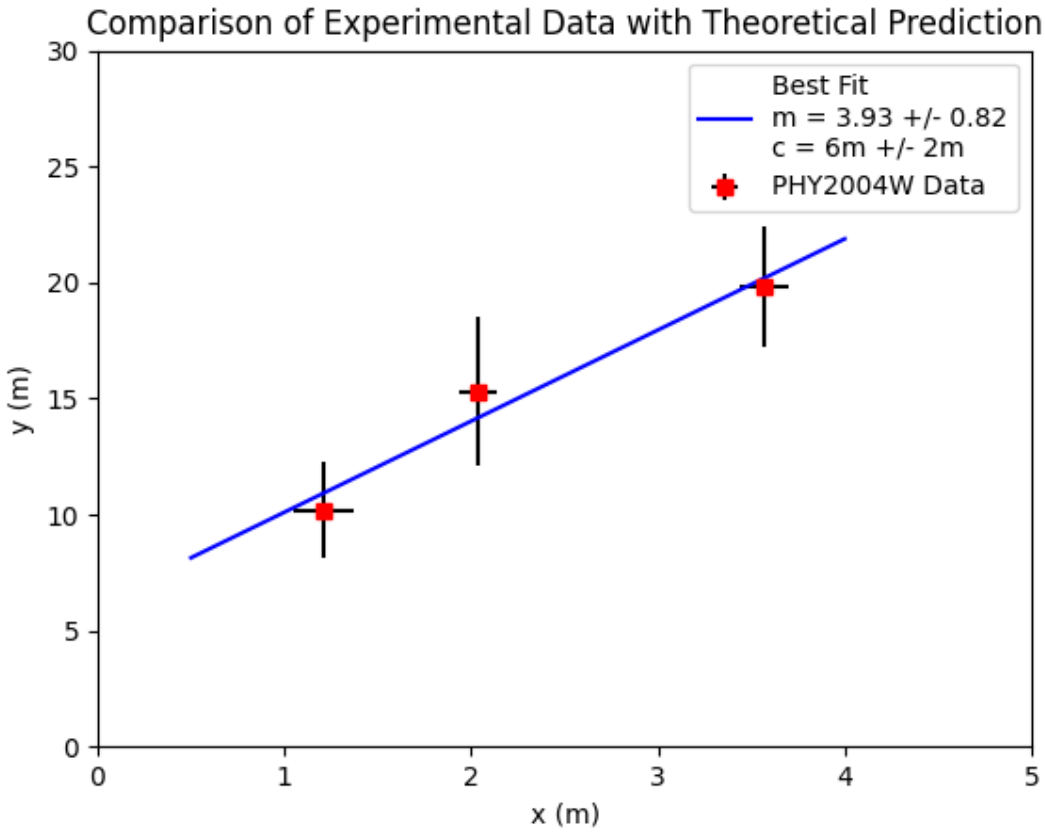


**Figure 1**

*Unweighted Linear Regression of Lab Data with Best Fit Line.*

The code used to produce these measurements and figures are attached to this document on the Vula submission.

## References

Harris, C. R., Millman, K. J., van der Walt, S. J., Gommers, R., Virtanen, P., Cournapeau, D., Wieser, E., Taylor, J., Berg, S., Smith, N. J., Kern, R., Picus, M., Hoyer, S., van Kerkwijk, M. H., Brett, M., Haldane, A., del Río, J. F., Wiebe, M., Peterson, P., … Oliphant, T. E. (2020). Array programming with NumPy. *Nature*, *585*(7825), 357–362. https://doi.org/10.1038/s41586-020-2649-2

Hunter, J. D. (2007). Matplotlib: A 2D graphics environment. *Computing in Science \& Engineering*, *9*(3), 90–95. https://doi.org/10.1109/MCSE.2007.55

Learning, I. for the A. of U., &, & Statis tics, D. of. (2002). *Lecture 5: Confidence Intervals*. University of Oxford. https://www.stats.ox.ac.uk/pub/bdr/IAUL/Course1Notes5.pdf

Seabold, S., & Perktold, J. (2010). Statsmodels: Econometric and Statistical Modeling with Python. *Proceedings of the 9th Python in Science Conference*, 92–96. https://doi.org/10.25080/majora-92bf1922-011