Physics 441/PCSE 503 Assignment 1

Due Date: Friday, September 8, 2023

1. Floating Point Binary Representation

Modify the JupyterNotebook called:

~/JupyterNotebooks/Week1/Binary\_Representation.ipynb

to consider the case of 64-bit floating point binary representation.

1. Variation of g with Altitude

Using the JupyterNotebook called:

~/JupyterNotebooks/Week1/graphy\_air\_density\_residuals.ipynb

as a starting point, create a new notebook which analyzes the variation of the acceleration due to gravity, *g*, with altitude.

1. Fitting of Periodic Data
2. Create a function that simulates data that takes a periodic function with a form:

v = a0 + a1t + a2 sin(a4t) + a3 cos(a4t)

You should simulate data at a number of random times over an interval and include Gaussian errors for the data. The inputs ai should take the form of a 1-dimensional python array.

1. Setting a0 =0, a1 =1, a2 =1, a3 =1 and a4 =0, simulate a dataset from times t=20 to t = 35, containing 100 points with Gaussian errors with uncertainty 0.5
2. Fit the data with a function of the same form as above. Do the fit parameters agree, within error, with the expected values?
3. Now, define a NEW fitting function (for the same data) as

v=a0 + a1t + a2 sin( a3t + a4)

and refit the data and extract the fit parameters, with errors. Does this give

better or worse fit? Extra Credit: Show that the two fits are mathematically

equivalent, and then from this calculate the mathematical relationship between the fit parameters and errors of the two fit functions.