

Problem Set8

Data Modeling

For the given data, we use the Numerical recipes code *lfit* to perform least squares fit to the model equation $x=1/2gt^2$. The parameter g that minimizes the χ^2 of the data with the null hypothesis that the object has uniform acceleration is obtained in the first case with only the first 1s of the data points and in the second case with all the data points.

With *lfit*, we also obtain $Q(\frac{N-2}{2}, \frac{\chi^2}{2})$ which is calculated using the *gammaq* function.

The Results are

1s	g	chi ²	Q
	9.71291	10.2904	0.245229
10s	7.98523	466.242	2.5485e-49

In the first case, $Q \sim 24\%$ shows only $1/4^{\text{th}}$ likelihood of the hypothesis being correct, yet it's a good approximation. Also a χ^2 of 10.3 shows that the model is a good fit to the data.

In the second case, we see a much higher χ^2 ; also the Q value clearly shows that hypothesis of a constant acceleration is wrong.

With increasing time, drag/air resistance is supposed to affect the motion. A velocity dependent term, or a cubic dependence on time, would not be apparent during the short time, but would become more apparent later on.