

Statistics Project 1 :

Statistics - Math 2606

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1 Experiment

2 Results

Our estimates for the standard deviation of the measurements, up to an order of magnitude, are as follows:

$$\sigma_{h_1} = 1\text{cm}$$

$$\sigma_{d_1} = 1\text{dm}$$

$$\sigma_{d_2} = 1\text{m}$$

To determine the impact of the error, we want to understand the change in the height of Searles with regard to a change in the distance from the mirror to the base of Searles, the mirror to Will, and the height of Will. We simply take the partial derivatives with respect to each quantity to understand how the height of Searles depends on these measurements.

$$\begin{aligned}\frac{\partial}{\partial H_w} &= \frac{D_s}{D_w} \\ \frac{\partial}{\partial H_s} &= \frac{H_w}{D_w} \\ \frac{\partial}{\partial D_s} &= -D_w^{-2} D_s H_w = -\frac{D_s H_w}{D_w^2}\end{aligned}$$

Measurement #	h_1	d_1	d_2	h_2
1	1.78	1.12	10.86	17.26
2	1.77	1.2	11.04	16.28
3	1.76	1.25	11.57	16.29
4	1.77	1.41	12.41	15.58
5	1.77	1.46	13.49	16.35
6	1.77	1.66	14.76	15.74
7	1.76	1.69	16.18	16.85
8	1.77	1.84	17.72	17.05
9	1.78	1.87	19.34	18.41
10	1.77	2.25	21.02	16.54
mean	1.77	1.575	14.839	16.635

Figure 1: Measurements for iris height (h_1), the distance from the mirror to Will (d_1), the distance from Searles to the mirror (d_2), and the resultant estimate of the height of Searles (h_2). All units are in meters.