Exercise

# Data Measurement

Determine the standard deviation of the measurement error for each of the problems described.

1. A manufacturing process makes subassembly frames for use in the aerospace industry. The frames have precise dimensional requirements. The frame length is specified at 82.55 cm with a tolerance of plus or minus .06 cm. The manufacturer measured their frames and based upon their measurement the average value for the frames was exactly 82.55 cm with a standard deviation of 3 mm. Due to the variation represented by the standard deviation of 3 mm, the company had a 5% scrap or rework rate. The customer inspected the frames when they received them. The customer used an inspection system that was more stable, had better resolution and was calibrated to an international standard. The customer also found that the average value was 82.5 cm, however, they found only a 1 mm standard deviation in the parts they received. What is the measurement system error that is contributing to the manufacturer’s higher error rate?
2. A farmer had a small basic weather station on his farm that he could use to check temperature, rainfall, humidity, barometric pressure, wind speed, and hours of direct sunlight (no clouds) during a day. The national weather service had a weather station directly across the road from where the farmer had placed his station. The national weather service station used state of the art equipment that was regularly calibrated and maintained. The farmer wanted to know how reliable his readings were. He regularly calibrated his system, but he was uncertain if the inherent variability in the systems would make the readings unreliable. He recorded his readings for thirty days and was able to obtain the national weather service readings for the same thirty days. The table below shows the results of a statistical analysis of the readings from both stations. Which of the farmer’s weather station measurements should he rely upon?

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| --- | --- | --- |
|  | Std Deviation National Weather Service | Std Deviation Farmer’s Weather Station |
| Temperature | 11 deg | 12 deg |
| Rainfall | 8 mm | 8 mm |
| Humidity | 9% | 11% |
| Barometric Pressure | 23 mm | 37 mm |
| Wind Speed | 3.4 K/hr | 4.4 K/hr |
| % Direct Sunlight | 17% | 17% |