



Problem Set #2

Issued: Wednesday, Feb. 12, 2003

Due: Friday, Feb. 21, 2003

Please write and hand in solutions to the following problems or scenarios. Write your solutions from the perspective of an engineer sending an explanation to a coworker (or a customer, or a supplier) of your solution. That is to say, you must write supporting text explaining equations and formulas that you use; a few mathematical expressions and a number or plot at the end will not earn full credit.

Problem 1

We are considering the recalibration of a low-pressure chemical vapor deposition (LPCVD) furnace. The furnace will be shut down for repairs if a significant difference is found between the thermocouple readings that are controlling the deposition temperature at the two ends of the tube. The following temperatures have been measured during a test run:

Table 1: Measured Left/Right Temperatures in LPCVD Test Run ($^{\circ}\text{C}$)

Left	606.5	605.0	605.5	605.5	606.2	606.5	603.7	607.7	607.7	604.2
Right	604.0	604.5	605.5	605.7	605.5	605.2	606.0	606.5	607.7	604.2

Part a. Do these temperatures have the same mean on both ends of the tube? ($\alpha = 0.05$)

Part b. Find the 90% confidence interval of the ratio of the two variances (Left/Right).

Part c. Find the sample size needed to confirm a 1°C deviation with a β of 10% when the σ is known to be 1°C (assuming $\alpha = 0.05$ as in part a).

Problem 2

A normally distributed quality characteristic is monitored by a control chart with $3\text{-}\sigma$ control limits.

Part a. Develop a general expression for the probability that a point will plot outside the control limits when the process is really in control.

Part b. Develop a general expression for the probability that 2 out of 3 consecutive points will lie on the same side of the center line, but outside the $2\text{-}\sigma$ line, when the process is really in control (this is the WECO #2 rule).