UNIVERSITY OF CALIFORNIA
College of Engineering
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Fall 2005

PROBLEM SET No. 3
Due on Thursday, September 29th, 2005

1. Suppose the concentration of particles produced in an etching operation on any given day is normally distributed with a mean of 15.08 particles/ft^3 and a standard deviation of 0.05 particles/ft^3. The specifications on the process call for a concentration of 15.00 +/- 0.15 particles/ft^3. What fraction of etching systems conform to specifications?

2. An IC manufacturing process is subject to defects which obey a Poisson distribution with a mean of four defects/wafer.

   (a) Assuming a single defect will destroy a wafer, calculate the functional yield of the process.

   (b) Suppose we can add extra redundant die to account for the defects. Assuming one redundant die is needed to replace exactly one defective die, how many dice are required to insure a yield of at least 50%?

5. Suppose we are interested in calibrating a chemical vapor deposition furnace. The furnace will be shut down for repairs if significant difference is found between the thermocouples that are measuring the deposition temperature at the two ends of the furnace tube. The following temperatures have been measured during several test runs:

Thermocouple 1 (^{o}C)	Thermocouple 2 (^{o}C)
606.5	604.0
605.0	604.5
605.5	605.5
605.5	605.7
606.2	605.5
606.5	605.2
603.7	606.0
607.7	606.5
607.7	607.7
604.2	604.2

   (a) Using the appropriate hypothesis test, determine whether or not we can be 95% confident that these temperatures are the same at both ends of the tube.

   (b) Find the 90% confidence interval for the ratio of the two variances ($\sigma_{T1}^2 / \sigma_{T2}^2$).

   (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.