

Instructions

You can submit the homework either in paper or online

- Online: Take pictures of the written (theory) part; submit them (along with the simulation part) on Canvas before the lecture on Friday
- Paper: Print out the result of the simulation part and staple it with the written work; hand it in at the beginning of the lecture on Friday

Problems

1. Problem 1: On the basis of extensive tests, the yield point of a particular type of mild steel reinforcing bar is known to be normally distributed with $\sigma = 100$. The composition of the bar has been slightly modified, but the modification is not believed to have affected either the normality or the value of σ .
 - (a) Assuming this to be the case, if a sample of 25 modified bars resulted in a sample average yield point of 8439 lb, compute a 90% CI for the true average yield point of the modified bar.
 - (b) How would you modify the interval in part (a) to obtain a confidence level of 92%?
2. Problem 2: The article “Evaluating Tunnel Kiln Performance” (Amer. Ceramic Soc. Bull., Aug. 1997: 59–63) gave the following summary information for fracture strengths (MPa) of $n = 169$ ceramic bars fired in a particular kiln: $\bar{x} = 89.10$; $s = 3.73$.
 - (i) Calculate a (two-sided) confidence interval for true average fracture strength μ using a confidence level of 95%.
 - (i) Suppose the investigators had believed a priori that the population standard deviation was about 4 MPa. Based on this supposition how large a sample would have been required to estimate μ to within .5 MPa with 95% confidence?
3. Problem 3: A sample of 14 joint specimens of a particular type gave a sample mean proportional limit stress of 8.48 MPa and a sample standard deviation of .79 MPa (“Characterization of Bearing Strength Factors in Pegged Timber Connections,” J. Struct. Engrg., 1997: 326–332). Assuming that proportional limit stress follows normal distribution, calculate and interpret a 95% lower confidence bound for the true average proportional limit stress of all such joints.

4. The target thickness for silicon wafers used in a certain type of integrated circuit is $245 \mu m$. A sample of 50 wafers is obtained and the thickness of each one is determined, resulting in a sample mean thickness of $246.18 \mu m$ and a sample standard deviation of $3.60 \mu m$.

At significant level $\alpha = 0.01$, does this data suggest that true average wafer thickness is something other than the target value?

5. A fish survey is done to see if the proportion of fish types is consistent with previous years. Suppose, the 3 types of fish recorded: parrotfish, grouper, tang are historically in a 5:3:4 proportion and in a survey the following counts are found.

| Type of fish | parrotfish | grouper | tang |
|--------------|------------|---------|------|
| Observed | 53 | 22 | 49 |

Do a test of hypothesis to see if this survey of fish has the same proportions as historically.