Review of Introduction to Probability and Statistics

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Homework #3

1. A 1-gallon can of paint covers an average of 513.3 square feet with a standard deviation of 51.5 square feet. Consider a sample of 40 of these 1-gallon cans. What is the probability that this sample will cover between 510 and 520 square feet per can?

2. A manufacturing process produces nominally 800-lumen LED bulbs with a standard deviation of 12 lumens. To test the output of the manufacturing process, a sample of 140 bulbs are measured. If the mean of this sample is to be used for control purposes, what can be said with 99% probability about the maximum size of the error of the sample mean?

3. In six measurements of the melting point of tin, a chemist obtained a mean and standard deviation of 232.26 and 0.14 Celsius, respectively. What is the 98% confidence interval for the chemist's estimate of the actual melting point of tin?

4. A fuse manufacturer claims that at a certain current their fuse will blow in 12.4 minutes on average. To test this claim, 20 fuses were selected at random from a manufacturing lot and subjected to the specified test current. The mean time to blow for this sample was 10.63 minutes, with a standard deviation of 2.48 minutes. Does this data tend to support or refute the manufacturers claim? Assume that fuse time to blow follows a normal distribution.

5. An infinite population is known to have a standard deviation that is 18% of the mean. When using a sample to measure the mean of this population, how big must the sample size be so that the standard error of the sample mean is 2% of the mean?

6. An optical lens manufacturer purchases starting glass material in slabs and knows that historically the refractive index of the slabs has a variance of 1.26×10^{-4}. For a particularly critical product they sample the incoming glass and reject a shipment if the sample variance of a 20 piece sample exceeds 2.0×10^{-4}. Assuming that the sample is randomly drawn from a normal population, what is the probability that an historically typical shipment will be incorrectly rejected?

7. An engineer wishes to investigate whether a process change will improve the yield of a manufacturing process. If y_1 is the yield of the existing process of record, and y_2 is the yield of the proposed process, write the most appropriate null and alternative hypotheses for an hypothesis test.

8. The specification for the breaking strength of a certain fishing line is 18 pounds. If five samples of that fishing line are obtained and tested to give a mean strength of 16.9 pounds, with a standard deviation of 0.9 lbs, use an hypothesis test to answer the question "is this line meeting its specifications?"

9. Two processes are being compared to determine if one produces wires with a lower resistance. For process 1, 32 samples are prepared yielding $\bar{x}_1$ = 0.106 Ω and s_1 = 0.008 Ω. For process 2, 45 samples are prepared yielding $\bar{x}_2$ = 0.093 Ω and s_2 = 0.010 Ω. At the 0.05 significance level, are these two processes different?

10. The table below gives average weekly losses of worker-hours due to accidents at 10 warehouses before and after a certain safety program was put into place.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Before	45	73	46	124	33	57	83	34	26	17
After	36	60	44	119	35	51	77	29	24	11

Using a 0.05 significance level, was the safety program effective?

11. An experiment makes 49 measurements and finds a mean of 12.4 and a standard deviation of 2.9. Create 95% confidence intervals for both of these statistics.