

Eco220 Exercise 5

1. Your company makes cables for elevators, an individual cable has to have a breaking strain of at least 4000 lbs and experience has shown that in testing the breaking strain measurement has a variance of 144 lbs².

i) Outline the way you would formulate a statistical test based upon the breaking strains of a sample taken from a batch tested to destruction to see if the rest of the batch are good enough for use. Discuss the type of errors the test could make and explain which of the errors you would make type 1.

ii) A sample of 81 cables yielded $\bar{x} = 4004$. Test $H_0: \mu \leq 4000$ against $H_1: \mu > 4000$. Set the size of the test at .05. What would you conclude?

2. Explain the meaning and importance of the following 4 concepts. Type I error, Type 2 Error, The size of a test, The Power of a test.

3) The following set of data {4, 4.2, 3.1, 2, 2.4, 4.7, 5.4, 4, 4.1, 1.1} is a random sample drawn from a population that is known to be normally distributed with a variance of 10.

i) Test the hypothesis that the mean of the population distribution is equal to 5 setting the size of the test at .05.

ii) A second sample is drawn {4, 4.3, 3, 2.6, 2.3, 4, 5.2, 4.1, 4, 1.5} combining the two samples test the hypothesis that the mean of the population distribution is equal to 5 setting the size of the test at .05.

iii) Comment on the conclusions in parts i) and ii).

4) i) A hypothesis is rejected when a test is performed at the .01 level, would the hypothesis be rejected at the .05 level? Explain.

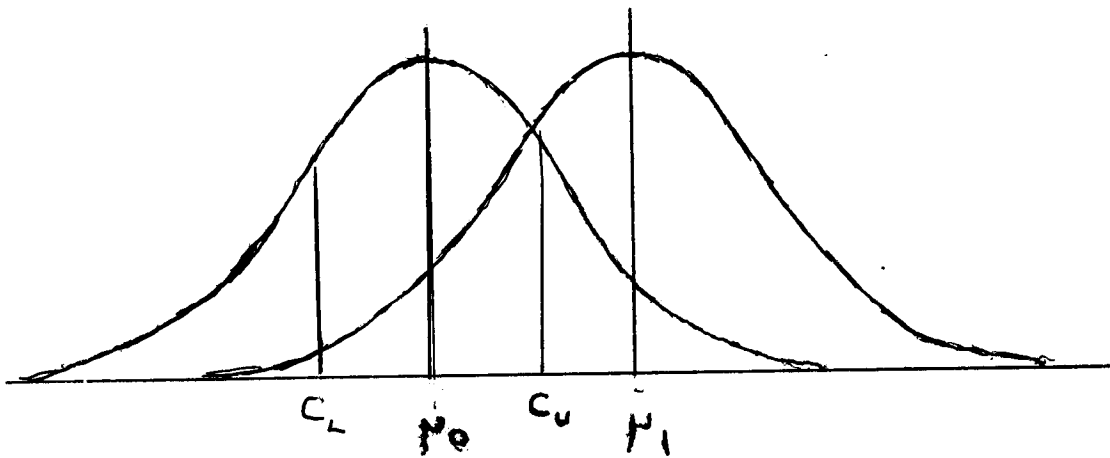
ii) A hypothesis is rejected when a test is performed at the .05 level, would the hypothesis be rejected at the .01 level? Explain.

5) Your company makes tablets to control blood coagulation. A byproduct of the production process is the insertion in the tablets of an ingredient which, in doses exceeding .025 milligrams, is potentially lethal.

i) Outline the way you would formulate a statistical test for the presence of the ingredient based upon a sample of tablets taken from a batch and tested to destruction to see if the rest of the batch are good enough for use. Discuss the type of errors the test could make and explain which of the errors you would make type 1.

ii) A sample of 49 tablets yielded an average presence of $\bar{x} = .0251$ milligrams with a sample variance of 0.000001. Set the size of the test at .05. What would you conclude?

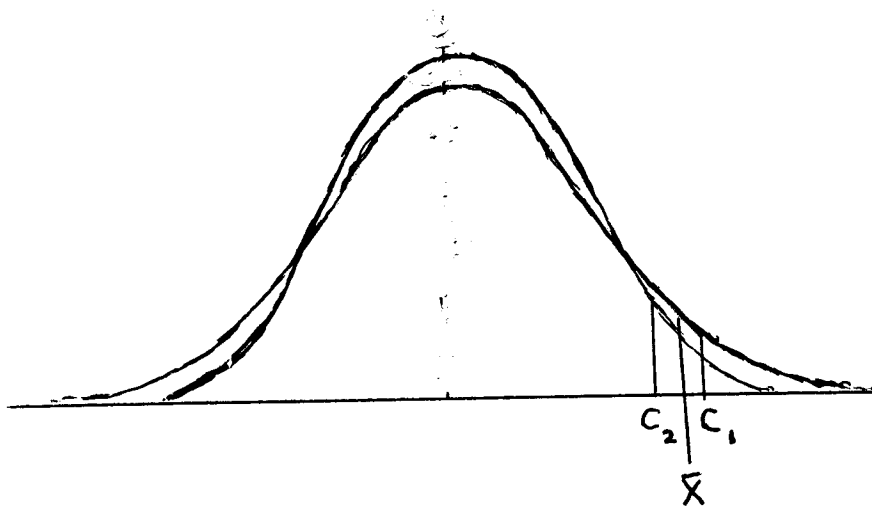
6) The following diagram illustrates the distributions of the sample mean under the null (μ_0) and under a value in the alternative (μ_1) when the test $H_0: \mu = \mu_0$, $H_1: \mu \neq \mu_0$ is performed with critical values C_L and C_U . Indicate the areas corresponding to the size of the test, the power of the test and the probability of a type 2 error.



7) The following diagram illustrates the distribution of the sample mean under the null for two sample sizes n_1 and n_2 (where $n_1 < n_2$) together with the corresponding critical values (C_1 and C_2) for a one sided upper tailed test. The sample mean \bar{X} is the same for both sample sizes.

i) What would the decision be in each case?

ii) Explain why the decision is different when the evidence (\bar{X}) is apparently the same in both cases.



8. Calculate the 99% confidence interval for the population mean in question 1.
9. Calculate the 99% confidence interval (based upon the initial sample) for the population mean in question 3, then calculate the 99% confidence interval based upon the augmented sample for the population mean, what is the difference in the intervals and why?
10. Calculate the 99% confidence interval for the population mean in question 5. How does this relate to the diagrams in question 7?