

A few problems for practice...

- 1) A company is ordered to reduce the mean discharge from their plant into a nearby river to less than 500 manganese parts per million. Does the company have significant evidence to show that it complied?
 - a) What null and alternate hypothesis should be tested?
 - b) What would a type I error be for this problem? A type II error?
 - c) A sample of size 25 revealed values between 162.8 and 635.4. The mean concentration observed was 402.1 and the observed standard deviation was 112.2. Perform the test of the hypothesis in a at an α -level of 0.05.
 - d) Say it was desired to construct a confidence interval instead. Construct a 90% confidence interval for the true mean discharge.
 - e) What assumptions do you need to make for parts b and c? Is this test robust against the violations of these assumptions?

- 2) A 6 should show one out of six times a fair die is rolled. To test if a die is fair it is rolled fifty times.
 - a) What null and alternate hypotheses should be tested to see if the die is fair?
 - b) Is the sample size large enough to conduct a test of these hypotheses?
 - c) Ten sixes are observed out of the fifty. What is the p-value for performing this test?
 - d) Do you accept or reject the null hypothesis at an α -level of 0.01?

- 3) To improve the signal-to-noise ratio (SNR) in the electrical activity of the brain, neurologists repeatedly stimulate subjects and average the responses - a procedure that assumes that single responses are homogeneous. A study was conducted to test this homogeneous signal theory (*IEEE Engineering in Medicine and Biology Magazine*, Mar. 1990). If the theory is true, the variance of the SNR subjects will equal 0.54, and it will exceed 0.54 if it is false.
 - a) What null and alternate hypotheses should be used if we are looking for evidence that the theory is not true? What are the type I and type II errors in this case?
 - b) A sample of size 41 is observed and has an observed variance of 0.5513. What is your conclusion at an α -level of 0.05?
 - c) What values can we bound the p-value between?
 - d) What assumptions must be true for this test to be valid? Is the test robust against violations of these assumptions?