


SC222: Tutorial Sheet 10

Problems based on Hypothesis testing.

Pb 1)  A farmer claims to be able to produce larger tomatoes. To test this claim, a tomato variety that has a mean diameter size of 8.2 centimeters with a standard deviation of 2.4 centimeters is used. If a sample of 36 tomatoes yielded a sample mean of 9.1 centimeters, does this prove that the mean size is indeed larger? Assume that the population standard deviation remains equal to 2.4, and use the 5 percent level of significance.

Pb 2) Consider a test of $H_0 : \mu \leq 100$ versus $H_1 : \mu > 100$. Suppose that a sample of size 20 has a sample mean of $\bar{X} = 105$. Determine the p value of this outcome if the population standard deviation is known to equal

- (a) 5
- (b) 10
- (c) 15

Pb 3) It is extremely important in a certain chemical process that a solution to be used as a reactant have a pH level greater than 8.40. A method for determining pH that is available for solutions of this type is known to give measurements that are normally distributed with a mean equal to the actual pH and with a standard deviation of 0.05. Suppose 10 independent measurements yielded the following pH values:

8.30, 8.42, 8.44, 8.32, 8.43, 8.41, 8.42, 8.46, 8.37, 8.42

Suppose it is a very serious mistake to run the process with a reactant having a pH level less than or equal to 8.40.

- (a) What null hypothesis should be tested?
- (b) What is the alternative hypothesis?
- (c) Using the 5 percent level of significance, what would you advise to use or not to use the solution?
- (d) What is the p value of the hypothesis test?

Pb 4) A previous sample of fish in Lake Michigan indicated that the mean polychlorinated biphenyl (PCB) concentration per fish was 11.2 parts per million with a standard deviation of 2 parts per million. Suppose a new random sample of 10 fish has the following concentrations:


11.5, 12.0, 11.6, 11.8, 10.4, 10.8, 12.2, 11.9, 12.4, 12.6

Assume that the standard deviation has remained equal to 2 parts per million, and


test the hypothesis that the mean PCB concentration has also remained unchanged at 11.2 parts per million. Use the 5 percent level of significance.

- Pb 5) A population distribution is known to have standard deviation 20. Determine the p value of a test of the hypothesis that the population mean is equal to 50, If the average of a sample of 64 observations is
- (a) 52.5
 - (b) 55.0
 - (c) 57.5

- Pb 6) An ambulance service claims that at least 45 percent of its calls involve life-threatening emergencies. To check this claim, a random sample of 200 calls was selected from the service's files. If 70 of these calls involved life-threatening emergencies, is the service's claim believable
- (a) at the 5 percent
 - (b) at the 1 percent level of significance?

- Pb 7)  A revamped television news program has claimed to its advertisers that at least 24 percent of all television sets that are on when the program runs are tuned in to it. This figure of 24 percent is particularly important because the advertising rate increases at that level of viewers. Suppose a random sample indicated that 50 out of 200 televisions were tuned in to the program.

- (a) Is this strong enough evidence, at the 5 percent significance level, to establish the accuracy of the claim?
- (b) Is this strong enough evidence, at the 5 percent significance level, to prove that the claim is unfounded?
- (c) Would you say that the results of this sample are evidence for or against the claim of the news program?
- (d) What do you think should be done next?

- Pb 8)  Psychologists who consider themselves disciples of Alfred Adler believe that birth order has a strong effect on personality. Adler believed that firstborn (including only) children tend to be more self-confident and success-oriented than later-born children. For instance, of the first 102 appointments to the U.S. Supreme Court, 55 percent have been firstborn children, whereas only 37 percent of the population at large are firstborn.

- (a) Using these data about the Supreme Court, test the hypothesis that the belief of Adlerians is wrong and being firstborn does not have a statistical effect on one's personality.
- (b) Is the result of (a) a convincing proof of the validity of the Adlerian position?