

Homework 7

Write a .Rmd file to answer these questions, knitting it to .html along the way. Start by pasting this outline to help the grader find your answers:

(Your Name Here)

1. Skin wounds

1a.

1b.

1c.

1d.

1e.

2. Test and power

2a.

2b.

2c.

1. Biologists studying the healing of skin wounds measured the rate at which new cells closed a cut made in the skin of an anesthetized newt. Here are data from a random sample of 18 newts, measured in micrometers (millionths of a meter) per hour:

29, 27, 34, 40, 22, 28, 14, 35, 26, 35, 12, 30, 23, 18, 11, 22, 23, 33

- (a) Create a QQ plot of the data. Do you think it is reasonable to assume that the population distribution is normal? Explain your answer. (There isn't a unique "right" answer.)
- (b) Regardless of your answer to (a), assume the population distribution is normal and use that assumption to create a 90% CI for μ , the population mean rate.
- (c) Consider a test of $H_0 : \mu = 25$ vs. $H_A : \mu \neq 25$ using significance level 0.10 (not the usual 0.05). Based on your 90% interval and no new calculations, say whether you would reject H_0 .
- (d) Test whether these data are strong evidence that the population mean rate is significantly greater than 25 at level $\alpha = .05$. (Note that you found a 90% confidence interval, not a 95% interval, and the interval was two-sided, but this test is one-sided, so the interval isn't directly useful for deciding this test.) Use a p-value to decide the test.
- (e) Suppose the problem statement included the addition, "Prior experience in the lab indicates that the population standard deviation is close to $\sigma = 8$ (micrometers per hour)." This would call for which changes to your confidence interval calculation? Write down the letters of all that are correct.
 - i. Replace \bar{x} with $\frac{\bar{x}}{n}$.
 - ii. Replace $t_{17,.05}$ with $z_{.05} = 1.645$.

- iii. Replace \sqrt{n} with n .
 - iv. Replace s (calculated from the data) with $\sigma = 8$.
 - v. Replace s (calculated from the data) with $\frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{18}}$.
2. A random sample of size $n = 10$ is taken from a large population. Let μ be the unknown population mean. A test is planned of $H_0 : \mu = 12$ vs. $H_A : \mu \neq 12$ using $\alpha = 0.1$. A QQ plot indicates it is reasonable to assume a normal population. From the sample, $\bar{x} = 14.2$ and $s = 4.88$.
- (a) Since the data leave it plausible that the population is normal, and the population standard deviation σ is unknown, a t -test is appropriate. Compute the p-value of the test. Do you reject or not reject H_0 ?
 - (b) Based on the test (and without calculating the interval), say whether you expect a 90% confidence interval to include 12.
 - (c) Using $s = 4.88$ as our best guess of σ (that is, pretending we know $\sigma = 4.88$), compute the power of a future test of $H_0 : \mu = 12$ vs. $H_A : \mu \neq 12$ if the true population mean is $\mu_A = 15$.