STAT 205, Spring 2015

Homework 7

Out: Thursday April 2. Due in: Thursday April 9. Write up the first two problems on one page, and the last two problems on another page.

- Exercise 7.5.13, six bar wrasse data. Carefully define μ_1 and μ_2, and state the null and (one-sided) alternative hypotheses for this problem. Do you need to check for normality for these data? Why or why not? Carry out the test at the $\alpha = 0.05$ level (not $\alpha = 0.1$ as the book states) using R; show your code. The data are on the course webpage (look for "chapter 7 data" in the March 5 row).
- Exercise 7.7.3(a) using R; show your code. Carry out the test at the $\alpha = 0.05$ level (not $\alpha = 0.1$ as the book states).
- Exercise 8.2.3 (**cAMP** data). Use R and show your code. Manually input the data.
- Exercise 8.4.6 (**Junco birds** data) using binom.test in R; show your code. The data are on the course webpage (look for "chapter 8 data" in the March 26 row).

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bracketed as $0.06 < P\text{-value} < 0.10$. Recall that the sample mean for the group 1 (the control group) was 15.9, which was less than the sample mean of 11.0 for group 2 (the group treated with Ancymidol). However, Ancymidol is considered to be a growth inhibitor, which means that one would expect the control group to have a larger mean than the treatment group if ancy has any effect on the type of plant being studied (in this case, the Wisconsin Fast Plant). Suppose the researcher had expected ancy to retard growth—before conducting the experiment—and had conducted a test of H_0: $\mu_1 = \mu_2$ against the nondirectional alternative hypothesis H_A: $\mu_1 > \mu_2$, using $\alpha = 0.05$. What would be the bounds on the P-value? Would H_0 be rejected? Why or why not? What would be the conclusion of the experiment? (*Note:* This problem requires almost no calculation.)

7.5.13 (Computer exercise) An ecologist studied the habitat of a marine reef fish, the six bar wrasse (*Thalassoma hardwicke*), near an island in French Polynesia that is surrounded by a barrier reef. He examined 48 patch reef settlements at each of two distances from the reef crest: 250 meters from the crest and 800 meters from the crest. For each patch reef, he calculated the "settler density," which is the number of settlers (juvenile fish) per unit of settlement habitat. Before collecting the data, he hypothesized that the settler density might decrease as distance from the reef crest increased, since the way that waves break over the reef crest causes resources (i.e., food) to tend to decrease as distance from the reef crest increases. Here are the data:[42]

250 METERS			800 METERS		
0.318	0.758	0.318	0.941	0.289	0.399
0.637	0.372	0.524	0.279	0.392	0.955
0.196	0.637	1.404	1.021	0.725	0.531
0.624	1.560	0.000	0.108	1.318	0.252
0.909	0.207	1.061	0.738	0.612	1.179
0.295	0.685	0.590	0.907	0.637	0.442
0.594	0.000	0.363	0.503	0.181	0.291
0.442	1.303	1.567	0.637	0.941	0.579
1.220	0.898	1.577	1.498	0.265	0.252
1.303	1.157	0.312	0.866	0.979	0.373
0.187	0.970	0.758	0.588	0.909	0.000
1.560	0.624	0.505	0.606	0.283	0.463
0.849	1.592	0.909	0.490	0.337	1.248
2.411	1.019	0.362	0.163	0.813	2.010
1.705	0.829	0.329	0.277	0.000	1.213
1.019	0.884	0.909	0.293	0.544	0.808

For 250 meters, the sample mean is 0.818 and the sample SD is 0.514. For 800 meters, the sample mean is 0.628 and the sample SD is 0.413. Do these data provide statistically significant evidence, at the 0.10 level, to support the ecologist's theory? Investigate with an appropriate graph and test.

7.7.3 Suppose you are planning a greenhouse experiment on growth of pepper plants. You will grow n individually potted seedlings in standard soil and another n seedlings in specially treated soil. After 21 days, you will measure Y = total stem length (cm) for each plant. If the effect of the soil treatment is to increase the population mean stem length by 2 cm, you would like to have a 90% chance of rejecting H_0 with a one-tailed t test. Data from a pilot study (such as the data in Exercise 2.62) on 15 plants grown in standard soil give $\bar{y} = 12.5$ cm and $s = 0.8$ cm.

(a) Suppose you plan to test at $\alpha = 0.05$. Use the pilot information to determine what value of n you should use.

(b) What conditions are necessary for the validity of the calculation in part (a)? Which of these can be checked (roughly) from the data of the pilot study?

(c) Suppose you decide to adopt a more conservative posture and test at $\alpha = 0.01$. What value of n should you use?

8.2.3 Cyclic adenosine monophosphate (cAMP) is a substance that can mediate cellular response to hormones. In a study of maturation of egg cells in the frog *Xenopus laevis,* oocytes from each of four females were divided into two batches; one batch was exposed to progesterone and the other was not. After two minutes, each batch was assayed for its cAMP content, with the results given in the table.[6] Use a t test to investigate the effect of progesterone on cAMP. Let H_A be nondirectional and let $\alpha = 0.10$.

	cAMP (pmol/oocyte)		
FROG	CONTROL	PROGESTERONE	d
1	6.01	5.23	0.78
2	2.28	1.21	1.07
3	1.51	1.40	0.11
4	2.12	1.38	0.74
Mean	2.98	2.31	0.68
SD	2.05	1.95	0.40

8.4.6 An ecological researcher studied the interaction between birds of two subspecies, the Carolina Junco and the Northern Junco. He placed a Carolina male and a Northern male, matched by size, together in an aviary and observed their behavior for 45 minutes beginning at dawn. This was repeated on different days with different pairs of birds. The table shows counts of the episodes in which one bird displayed dominance over the other—for instance, by chasing it or displacing it from its perch.[18] Use a sign test to compare the subspecies. Use a nondirectional alternative and let $\alpha = 0.01$.

	NUMBER OF EPISODES IN WHICH	
PAIR	NORTHERN WAS DOMINANT	CAROLINA WAS DOMINANT
1	0	9
2	0	6
3	0	22
4	2	16
5	0	17
6	2	33
7	1	24
8	0	40