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Assignment 8

Due: Friday November 27, 2020 11:59 PM (Atlantic Standard Time)

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Q1 (4 points)

The males of stalk-eyed flies (*Cyrotodiopsis dalmanni*) have long eye stalks. Is the male's eye-stalk length affected by the quality of its diet? An experiment was carried out in which two groups of male "stalkies" were reared on different foods (David et al. 2000). One group was fed corn (considered a high-quality food), while the other was fed cotton wool (a food of substantially lower quality). Each male was raised singly and so represent an independent sampling unit. The eye spans (the distance between the eyes) were recorded in millimeters. The raw data are as follows:

Corn diet: 2.15, 2.14, 2.13, 2.13, 2.12, 2.11, 2.10, 2.08, 2.08, 2.08, 2.04, 2.05, 2.03, 2.02, 2.01, 2.00, 1.99, 1.96, 1.95, 1.93, 1.89

Cotton diet: 2.12, 2.07, 2.01, 1.93, 1.77, 1.68, 1.64, 1.61, 1.59, 1.58, 1.56, 1.55, 1.54, 1.49, 1.45, 1.43, 1.39, 1.34, 1.33, 1.29, 1.26, 1.24, 1.11, 1.05

These data can be summarized as follows, where the corn-fed flies represent treatment group 1 and the cotton-fed flies represent group 2.

	Mean (mm)	Variance	Sample size (n)
Corn diet (group 1)	2.05	0.00558	21
Cotton diet (group 2)	1.54	0.0812	24

(a) What is the best test, paired t -test, or two-sample t -test (pooled) or two-sample Welch's t -test, to use for comparing the means of the two groups? Why?

(b) Carry out the test identified in part (a). (State the null and alternative hypotheses, report the test statistic value and/or the P-value and state your conclusion in the context.)

Q2 (6 points)

Fruit flies, like almost all other living organisms, have built-in rhythms that keep time even in the absence of external stimuli. Several genes have been shown to be involved in internal timekeeping, including *per* (*period*) and *tim* (*timeless*). Mutations in these two genes, and in other genes, disrupt time-keeping abilities. Interestingly, these genes have also been shown to be involved in other time-related behavior, such as the frequency of wingbeats in male courtship behaviors. Individuals that carry particular mutations of *per* and *tim* have been shown to copulate for longer than individuals that have neither mutation. But do these two mutations affect copulation time in similar ways? The following table summarizes some data on the duration of copulation for flies that carry either the *tim* mutation or the *per* mutation (Beaver and Giebultowics 2004):

Mutation	Mean copulation duration (mm)	Standard deviation of copulation duration	Sample size (n)
<i>per</i>	17.5	3.37	14
<i>tim</i>	19.9	2.47	17

Assume equal population standard deviations in this question.

- (a) Find a 90% confidence interval for the difference in mean copulation durations of the two mutations.
- (b) Do these two mutations lead to different mean copulation durations? Carry out the appropriate test. (State the hypotheses, the test statistic value and/or the P-value and the conclusion. Use $\alpha = 0.01$.)

Q3 (6 points)

Researchers studying the number of electric fish species living in various parts of the Amazon basin were interested in whether the presence of tributaries affected the local number of electric fish species in the main rivers (Fernandes et al. 2004). They counted the number of electric fish species above and below the entrance point of a major tributary at 12 different river locations. Here's what they found:

Tributary	Upstream number of species	Downstream number of species
1	14	19
2	11	18
3	8	8
4	5	7
5	10	16
6	5	6
7	23	24
8	29	30
9	19	16
10	16	20
11	25	21
12	10	12

- (a) Find a 95% confidence interval of the mean difference in the number of species between areas upstream and downstream.
- (b) Test the hypothesis that the tributaries have no effect on the number of species of electric fish.

(c) State the assumptions that you had to make to complete parts (a) and (b).

Q4 (2 points)

The Luso variety of wheat is resistant to the Hessian fly. In order to understand the genetic mechanism controlling this resistance, an agronomist plans to examine the progeny of a certain cross involving Luso and a nonresistant variety. Each progeny plant will be classified as resistant or susceptible and the agronomist will estimate the proportion of progeny that are resistant. How many progeny does he need to classify in order to guarantee that the margin of error of his estimate of this proportion will not exceed 0.02 at 95% level of confidence?