Homework 8.

(Due Nov. 10)

9.2.8 **Antibiotic Efficacies**
Eight cultures of a bacterium are split in half. One half is tested using a standard antibiotic and the other half is tested using a new antibiotic. The data values in DS 9.2.8 are the times taken to kill the bacterium. Use an appropriate hypothesis test to assess whether there is any evidence that the new antibiotic is quicker than the standard antibiotic.

9.3.2 In an unpaired two-sample problem an experimenter observes $n = 14, \bar{x} == 32.45, s_x = 4.30$ from population A and $m = 14, \bar{y} = 41.45, s_y = 5.23$ from population B.

(a) Use the pooled variance method to construct a 99% two-sided confidence interval for $\mu_A - \mu_B$.

(b) Construct a 99% two-sided confidence interval for $\mu_A - \mu_B$ without assuming equal population variances.

(c) Consider a two-sided hypothesis test of $H_0 : \mu_A = \mu_B$ without assuming equal population variances. Does a size $\alpha = 0.01$ test accept or reject the null hypothesis? Write down an expression for the exact p-value.

9.3.10 In an unpaired two-sample problem, an experimenter observes $n = 38, \bar{x} = 5.782$ from population A and $m = 40, \bar{y} = 6.443$ from population B. Suppose that the experimenter wishes to use values $\sigma_A = \sigma_B = 2.0$ for the population standard deviations.

(a) What is the exact p-value for the hypothesis testing problem $H_0 : \mu_A \geq \mu_B$ versus $H_A : \mu_A < \mu_B$?

(b) Construct a 99% one-sided confidence interval that provides an *upper bound* for $\mu_A - \mu_B$.

9.3.14 Consider again the data set in Problem 9.3.2 with sample sizes $n = m = 14$. If a two-sided 99% confidence interval for the difference in population means is required with a length no larger than $L_0 = 5.0$, what *additional* sample sizes would you recommend be obtained from the two populations?

9.3.22 (Significant level: 0.05) A random sample of $n = 16$ one-kilogram sugar packets of brand A have weights with a sample mean $\bar{x} = 1.053$ kg and a sample standard deviation $s_x = 0.058$ kg. In addition, a random sample of $m = 16$ one-kilogram sugar packets of brand B have weights with a sample mean $\bar{y} = 1.071$ kg and a sample standard deviation $s_y = 0.062$ kg. Is it safe to conclude that brand B sugar packets weigh slightly more on average than brand A sugar packets?

9.3.26 In an unpaired two=sample problem an experimenter observes $n = 10, \bar{x} = 7.76, s_x = 1.07$ from population A and $m = 9, \bar{y} = 6.88, s_y = 0.62$ from population B.

(a) Construct a 99% one-sided confidence interval $\mu_A - \mu_B \in (c, \infty)$ without assuming equal population variances.

(b) Does the value of c increase or decrease if a confidence level 95% is used?

(c) Consider a one-sided hypothesis test of $H_0 : \mu_A \leq \mu_B$ versus $H_A : \mu_A > \mu_B$ without assuming equal population variances. Does a size $\alpha = 0.01$ test accept or reject the null hypothesis? Write down an expression for the exact p-value.

9.7.10 A company is investigating how long it takes its drivers to deliver goods from its factory to a nearby port for export. Records reveal that with a standard specified driving route, the last $n = 48$ delivery times have a sample mean of $\bar{x} = 432.7$ minutes and a sample standard deviation of $s_x = 20.39$ minutes. A new driving route is proposed, and this has been tried $m = 10$ times with a sample mean of $\bar{y} = 403.5$ minutes and a sample standard deviation of $s_y = 15.62$ minutes. What is the evidence that the new route is quicker on average than the standard route?

9.7.14 **Reinforced Cement Strengths**
The strengths of nine reinforced cement samples were tested using two procedures. Each sample was split into two parts, with one part being tested with procedure 1 and the other part being tested with procedure 2. The resulting data set is given in DS 9.6.7. Use an appropriate hypothesis test to assess whether there is any evidence that the two testing procedures provide different results on average.

9.7.20 **Joystick Design for Spinal Cord Injury Patients**
Patients with spinal cord injuries can lose mobility in their arms and hands, and it is important to find the optimal design of a joystick that will enable them to perform tasks in the most efficient manner. An experimenter was designed to compare two joystick designs. As a target moved across a computer screen, the patients were asked to use a joystick to follow the target with a cursor. Nine spinal cord injury patients participated in the study, and each patient tried out both joystick designs. DS 9.6.11 contains data on the mean error measurements that were calculated by aggregating the distances between the target and the cursor at a series of time points.

9.7.22 **Sphygmomanometer and Finger Monitor Systolic Blood Pressure Measurements**
A sphygmomanometer is a standard instrument for measuring blood pressure in the arteries consisting of a pressure gauge and a rubber cuff that wraps around the upper arm. DS 9.6.13 compares blood pressure readings for 15 patients using this standard methods and a new method based upon a simple finger monitor. (Compare the two methods at the sig. level 0.05)