Lab: Practice Exercises in Preparation for Exam 2

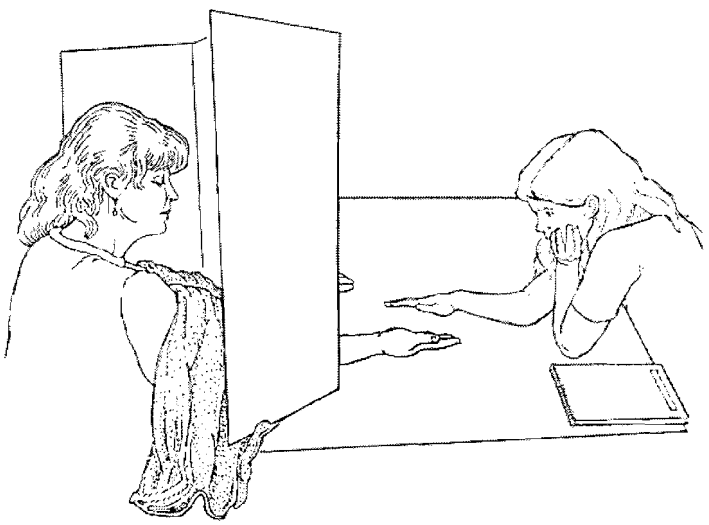
Google doc: last update 4/16/10

9.20 Lab reagent, hypothesis test. A lab reagent is alleged to have a true concentration of 5 mg/dL. Six measurements reveal concentrations of {5.32, 4.88, 5.10, 4.73, 5.15, 4.75}. These 6 measurements are assumed to be an SRS from the population of all measurements we would get if we were to measure the concentration repeatedly. The population of measurements is assumed to have a Normal distribution with a mean concentration equal to the true concentration and a standard deviation σ of 0.2. Carry out a test to determine if these six measurements give reliable evidence that the true concentration is not 5 mg/dL.

10.17 Lab reagent, 90% confidence interval for true concentration. In exercise 9.20 you were presented with six (6) measurements of a reagent in which the true concentration was supposed to be 5 mg/dL. The sample mean $\bar{x}$ was 4.9883, and the population of all potential measurements was assumed to have a Normal distribution with σ = 0.2 mg/dL. Calculate a 90% confidence interval for the true concentration of the solution. After calculating the confidence interval, return to the practical question that motivated exercise 9.20 to describe the results. What do you conclude?

9.21 Lab reagent, power analysis. Exercise 9.20 failed to show a significant difference in the mean concentrations in a lab reagent and a hypothetical value of 5. Suppose the true concentration of the reagent is 4.75. What was the power of the test to demonstrate this difference at α = .05 (two-sided)?

11.30 Therapeutic Touch, *n* = 28. Data come from the study described in Exercise 11.29 in the text. However, we now include an additional 8 observations, bringing the total sample size to 28. This experiment, which started as a fourth grade science fair project, evaluated whether trained Touch Therapist could correctly identify whether a human energy field of an unseen hand could be detected by a trained Though Therapist (Rosa et al., 1998). (The modality of Touch Therapy claims that each person has a human energy field that can be perceived and manipulated a trained therapist.) Each observation consisted of 10 attempts to identify the human energy field over either the left or right hand of the Therapist. The number of correct identifications (out of 10) were:



{1, 2, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4,4, 4, 5, 5, 5, 5, 5, 5, 5, 6, 6, 7, 7, 7, 8}

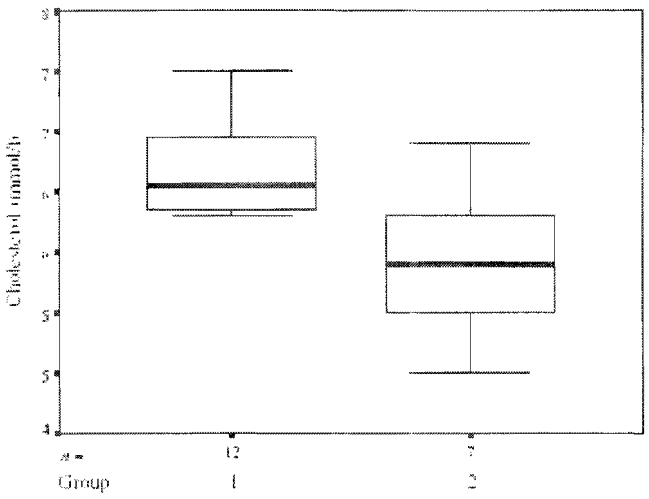
(a) Plot the data with a stemplot to explore its shape. (Use a stem multiplier of x1 and quintuple split stem values.) Are there any clear departures from Normality?

(b) Can you use a t procedures for inference with these data? Explain your response.

(c) Note: $\bar{x}$ = 4.393, s = 1.663, and n = 28. Calculate the 95% CI for μ. Then, based on this confidence interval, say whether the data are consistent with an assumption of random guessing.(Note: Random guessing is expected to achieve 5 of 10 correct identifications in the long run.)

12.23 Linoleic acid HDL cholesterol. Linoleic acid is a polyunsaturated fatty acid that is abundant in many vegetable oils, comprising over half (by weight) of poppy seed, safflower, sunflower, and corn oils. A comparison is made of two diets. Diet 1 is high in linoleic acid, while diet 2 is high in saturated fats.

(a) A boxplot comparing HDL cholesterol values (mmol/L) on the two diets is shown below. Interpret this boxplot.



(b) Descriptive statistics for the two groups are shown below. Is there a significant difference in the mean cholesterol levels in the two groups? Show all hypothesis testing steps. Use a two-sided alternative.

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
Cholesterol (mmol/l)	1	12	6.192	.3919	.1131
	2	7	5.414	.6492	.2454

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9.20 Lab reagent, hypothesis test. Let μ represent the solution's true concentration. $n = 6$, σ assumed to be 0.2. We calculate $\bar{x} = 4.9883$.

- H_0: $\mu = 5$ vs. H_a: $\mu \neq 5$
- $z_{\text{stat}} = \dfrac{4.9883 - 5}{0.2/\sqrt{6}} = -0.14.$
- One-sided P-value = $\Pr(Z < -0.14) = .4443$. Two-sided P-value = 2 × .4443 = .8886.
- The evidence against the null hypothesis is weak. Thus, the data give little evidence to doubt that the true concentration is 5.

10.17 Lab reagent, 90% CI for true concentration. Recall that $\bar{x} = 4.9883$; $n = 6$, and σ is assumed to be 0.2. For 90% confidence, use $z_{1-.05/2} = z_{.95} = 1.645$. $SE_{\bar{x}} = \dfrac{0.2}{\sqrt{6}} = 0.08165$

90% CI for $\mu = 4.9883 \pm (1.645)(0.08165) = 4.9883 \pm 0.1343 = (4.854 \text{ to } 5.123)$

9.21 Lab reagent, power.

$$1-\beta = \Phi\left(-z_{1-\frac{\alpha}{2}} + \frac{|\mu_0 - \mu_a|\sqrt{n}}{\sigma}\right) = \Phi\left(-1.96 + \frac{|5-4.75|\sqrt{6}}{0.2}\right) = \Phi(1.10) = 0.8643$$

11.30 Therapeutic Touch, n = 28.

(a) The stemplot shows no clear departures from Normality

```
0*|1
 t|233333333
 f|444445555555
 s|66777
 .|8
×1
```

(b) t procedures can be used because there are no clear departures from Normality and the sample is moderate in size.

(c) For 95% confidence, α = .05 and $t_{28-1,1-.05/2} = t_{27,.975} = 2.052$. $SE_{\bar{x}} = \dfrac{1.663}{\sqrt{28}} = 0.3143$. The 95% CI for $\mu = 4.393 \pm (2.052)(0.3143) = 4.393 \pm 0.6449 = 3.75$ to 5.04. Since "5" is included as a possible value in this 95% confidence interval, data are consistent with "5 out of 10" random guessing.

12.23 Linoleic acid and HDL cholesterol.

(a) Group 1 clearly has higher values on average.
(b) Hypothesis test

- H_0: $\mu_1 - \mu_2 = 0$ vs. H_a: $\mu_1 - \mu_2 \neq 0$
- $t_{stat} = \dfrac{6.192 - 5.414}{0.2702} = 2.87$ with $df_{\text{conserv}} = n_2 - 1 = 7 - 1 = 6$
- One-sided P-value from Table C is bracketed by .025 and .01. Thus, the two-sided P is between .05 and .02, constituting good evidence against H_0 ("significant difference").