

Review for Final: Math 263 Section 6

1. The length of the western rattlesnake is normally distributed with mean 42 inches and standard deviation 2 inches. Consider the sampling distribution of mean lengths of samples of 15 western rattlesnakes.
 - (a) What is the mean of the sampling distribution?
 - (b) What is the standard deviation of the sampling distribution?
 - (c) What is the probability that the mean length of a random sample of 15 western rattlesnakes is more than 42 inches?
 - (d) What is the effect of increasing the sample size on the mean and standard deviation of the sampling distribution? (check one in each column)

Mean	Standard deviation
Increases _____	Increases _____
Decreases _____	Decreases _____
Unchanged _____	Unchanged _____
Need further information _____	Need further information _____

2. Women in labor are given injections to deaden the pain. A hospital¹ wants to determine whether the injections are more effective if they are given when the woman is lying down or when she is sitting up. They randomly assigned women to two groups and measured the number of segments of the spine that were anesthetized in each group (larger numbers mean the anesthetic is more effective). The following table gives results from the two samples.

	Sample size	Average	Standard deviation
Lying	48	8.8	4.4
Sitting	35	7.1	4.5

Using the following steps and a 5% significance level, decide if the injections work better for women in one position or the other.

- (a) What is the null hypothesis?
 - (b) What is the alternative hypothesis?
 - (c) Calculate the statistic.
 - (d) What is the distribution of the statistic?
 - (e) What is the P -value of the statistic? What is its interpretation?
 - (f) What is your conclusion?

3. A psychologist is studying the effect of drug and electroshock therapy on a subject's ability to solve simple tasks. The number of tasks completed in a 10-minute period is recorded for subjects who have been randomly assigned to compare four treatment groups: drug with electroshock, drug without electroshock, no drug with electroshock, and no drug/no electroshock. Sixty-four subjects were randomly selected students from a large local university.
 - (a) State the null and alternative hypotheses for the researchers.
 - (b) What can the psychologist conclude from the following ANOVA output? Explain how your conclusion follows from this output. Assuming the technical conditions are met; the "Factor " is our "Between Groups" and ""Error" is our "Within Groups".

¹ National Women's Hospital in Auckland, NZ. Reported by C. Wild and G. Seber in *Chance Encounters*.

Analysis of Variance					
Source	DF	SS	MS	F	P
Factor	3	58.13	19.38	11.01	0.000
Error	60	105.63	1.76		
Total	63	163.75			

4. An insurance company writes policies for a large number of newly-licensed drivers each year. Suppose 30% of these are low-risk drivers, 50% are moderate risk, and 20% are high risk. The company has no way to know which group any individual driver falls in when it writes the policies. None of the low-risk drivers will have an at-fault accident in the next year, but 10% of the moderate-risk and 20% of the high-risk drivers will have such an accident.

- (a) Fill in the following table for the number of accidents among 100 newly-licensed drivers in the next year.

	At-fault accident	No at-fault accident	Total
Low risk			
Moderate risk			
High risk			
Total			100

- (b) If a driver has an at-fault accident in the next year, what is the probability that he or she is high-risk?
- (c) Are having an at-fault accident and risk status independent? Why?
5. In March 2004, a California father, Dr. Michael Newdow, argued in front of the Supreme Court that the phrase “under God” should be removed from the Pledge of Allegiance because it violates the constitutional principle of separation of church and state. A June 2003 poll of 1000 adults reported that 26% believed that the phrase should be removed.²
- (a) Find the 90% confidence interval for the percentage of adults who agree with Dr. Newdow. (Give your answer in percentages to one decimal place.)
- (b) What sample size is needed for a margin of error of 3% at the 95% confidence level? (Give your answer as a whole number.)

² USA Today, March 25, 2004, page 3A.

6. A simple random sample of 15 apparently healthy children between the ages of 6 months and 15 years yield data on age and liver volume per unit of body weight (ml/kg).

SUMMARY OUTPUT						
<i>Regression Statistics</i>						
Multiple R	0.788504					
R Square	0.621738					
Adjusted R Square	0.592641					
Standard Error	5.866846					
Observations	15					
ANOVA						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	735.4748	735.4748	21.36773	0.000478	
Residual	13	447.4585	34.41989			
Total	14	1182.933				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	48.53964	3.094431	15.68613	7.94E-10	41.85453	55.22476
Age	-1.5762	0.340982	-4.62252	0.000478	-2.31284	-0.83955

- (a) Is age useful in predicting liver volume? Explain why or why not.
 (b) What are the estimates of the slope and intercept for this model?
 (c) How do you interpret them?
 (d) How would you assess the fit of the model? Explain.
7. The oxygen demand in a lake or wetland is the concentration of oxygen needed for survival by the wildlife living in the area. An EPA (Environmental Protection Agency) report³ on a wetland in Marin County, California, noted that the mean oxygen demand was 9.9 mg/liter and that 95% of the readings were between 6.5 mg/liter and 13.3 mg/liter. Assume that oxygen demand is normally distributed.
- (a) Find the standard deviation of the oxygen demand. Give units with your answer.
 (b) An oxygen demand of less than 8 mg/liter suggests that some wildlife may be dying. What is the probability that such a reading is observed?
 (c) An oxygen demand of over 12 mg/liter suggests there may be too many organisms that endanger some types of plant life. What is the probability of such a reading?
 (d) What oxygen demand is at the 80th percentile?
8. Are the following statements true or false? Explain the reasons for your choice. You are given that
- The distribution of personal incomes in the US is skewed to the right.
 - The weights of healthy newborn babies are normally distributed with mean 3.43 kg and standard deviation 0.48 kg.
- (a) The distribution of mean incomes of samples of 1000 people is skewed to the right.
 (b) A particular random sample of 100 newborns is likely to have mean near 3.43 kg and standard deviation near 0.48 kg.
 (c) The sampling distribution of the means of 100 newborns has mean 3.43 kg and standard deviation 0.48 kg.

³EPA Report 832-R-93-005, used in *Understandable Statistics* 10th ed, by Brase and Brase.