

9.07 Practice Final (fall 2004):

1. Health and Nutrition Examination Survey of 1976-1980 recorded handedness of the 2,237 surveyed Americans aged 25-34:
At 1% significance level can you conclude that gender and handedness are not independent?

	Right Handed	Left Handed	Can be either
Male	934	113	20
Female	1,070	92	8

2. A study published by the government's Uniformed Services University of the Health Sciences in Bethesda, Md monitored the effect of taking aspirin on cardiac patients. 80%(751) of the 936 study participants were given aspirin. During the 2 years of the study, 22 of the 936 patients died from a heart attack. Of these, 10 were among the 185 who had not had aspirin to prevent a heart attack. The study concluded that fatality for non-users of aspirin was triple that for those on daily aspirin dose. At 1% significance level, test if the fatality rate of the aspirin non-users is twice that for those on daily aspirin dose.
3. Answer the following quickies with an answer and a short explanation
 - a) The chance of flipping exactly 50 heads in 100 independent tosses of a fair coin is nearly half. True or False? Explain.
 - b) If X denotes the number of successes in n independent Bernoulli trials, each trial having success probability p, and if Y denotes the number of failures, what is the variance of X-Y?
 - c) What is the variance of X+Y?
 - d) When estimating a proportion, a random sample of size 200 from a population of 20,000 is as accurate as a random sample of size 400 from a population of 40,000, assuming the true proportions are the same for both populations. True or False? Explain.
 - e) Using a t-test instead of a z-test to estimate a mean when a standard deviation is known, the data is roughly normal, and the sample size is small (under 30), will increase the chance of accepting an alternative hypothesis when null hypothesis is in fact correct. True or False? Explain.
4. Some defendants in criminal proceedings plead guilty and are sentenced without a trial, whereas others plead innocent, are subsequently found guilty, and then are sentenced. In recent years legal scholars have speculated as to whether the sentences of those who plead guilty differ in severity from the sentences of those who plead innocent and subsequently judged guilty. Consider the accompanying data on a group of defendants from San Francisco County, all of whom were accused of robbery and had previous prison records ("Does it pay to plead guilty? Differential Sentencing and the functioning of criminal courts" Law and Society Rev. (1981-1982)). Are the rates of being sentenced to prison significantly different at the .05 level?

	Plea	
	Guilty	Not Guilty
Number of judged guilty	n1=191	n2=64
Number sentenced to prison	101	56
Sample proportion	$p_1'=.529$	$p_2'=.875$

5. The paper “Veterinary Health Care Market for Dogs” studied annual veterinary costs for households owning dogs. They recorded the annual veterinary costs (in \$) for a random sample of 144 families. For these data:

$$\sum_{i=1}^{144} (x_i) = 10,656; \sum_{i=1}^{144} (x_i)^2 = 1,017,344$$

- a) Find the sample mean of the annual veterinary costs for one family owning a dog.
 - b) Find the sample standard deviation of the annual veterinary costs of a family owning a dog.
 - c) What will be distribution of the sample mean for a sample of size 144? With what parameters? Do we need to make any assumptions about distribution of X's?
6. 9.07 had two graders last year. The TA's job is to make sure the graders are equivalent.
- a. On the midterm, the TA gave each grader half the exams to grade and then examined the results, shown below:

	Grader1	Grader2
N (number of exams graded)	20	22
Mean	59	63
Std. Dev.	10	12

Were the two graders significantly different at the $\alpha=.05$ level?

- b. On the final, the TA decided to have both graders grade the first 5 exams to make sure they were equivalent. Here are the scores for the 5 exams that each grader assigned:

	Grader1	Grader 2
Exam 1	50	47
Exam 2	67	62
Exam 3	57	59
Exam 4	71	68
Exam 5	40	43

Were the two graders significantly different at the $\alpha=.05$ level?

c. Would the test be more powerful, less powerful, or the same if the TA compared the scores that the graders assigned to individual questions on the final? Explain your choice.

7. Lamarck believed that physically changing an animal would affect its offspring. In one experiment, he cut the tail off rats and bred them to see if the children would be born with shorter tails. Each child rat has a mother and a father, so Lamarck tested 4 groups, each with 16 offspring. Here are the data:

	Length of Offspring's Tails
Normal Mother, Normal Father	$m=45 \quad s^2 = 20 \quad n=16$
Normal Mother, Tailless Father	$m=38 \quad s^2 = 30 \quad n=16$
Tailless Mother, Normal Father	$m=47 \quad s^2 = 30 \quad n=16$
Tailless Mother, Tailless Father	$m=40 \quad s^2 = 20 \quad n=16$

Complete the following table (and define A and B):

SSA=	dfA=	MSA=	F _{obt,A} =
SSB=	dfB=	MSB=	F _{obt,B} =
SSAB=	dfAB=	MSAB=	F _{obt,AB} =
SSE=	dfE=	MSE=	
SST=	dfT=		

- Which factor(s) are significant (A, B, or both)?
- Is there an interaction? Is it significant?
- Determine whether Tailless Mothers produce significantly greater tail lengths in their offspring than Normal Mothers.
- What should Lamarck report about whether the mother's tail length influences the child's tail length? Explain your reasoning.