

Name: _____

Directions: This exam contains eight problems worth a total of 150 points. For each computational problem, you must first write the formula to be used and present all your subsequent work in order to receive full or partial credit. Circle your final answers.

1. Briefly, but clearly, describe an example of a study in which there is a potential selection bias. (10 pts.)
2. The table below shows the numbers of coniferous (pointed-leaf) trees and deciduous (broad-leaf) trees found a small section of a forest at two sites (North; South).

Site	Type of tree	
	Coniferous	Deciduous
North	77	41
South	84	93

- (a) Conduct a test of hypotheses to determine whether the relative proportions of the two types of trees are homogeneous between the two sites. Use $\alpha = .01$. (15 pts.)

H_0 :

H_a :

Compute the test statistic and define the rejection rule.

Should the null hypothesis be rejected? Circle one. Yes No

- (b) Does the test conducted in (a) satisfy the assumption about the expected counts? Justify your answer. (5 pts.)

3. Ten percent of the Porsche cars sold in the U.S. are black. You will observe 10 Porsche cars on the road. Assume that these 10 cars constitute a random sample.

(a) Compute the probability that exactly 6 of the 10 cars will be black. (10 pts.)

(b) Compute the probability that at least 1 of the 10 cars will be black. (10 pts.)

4. Vitamin B₆ is one of the vitamins in a multiple vitamin pill manufactured by a pharmaceutical company. The pills are produced with a mean of 50 mg of vitamin B₆ per pill. The company believes that there is a deterioration of 1 mg per month, so that they expect the mean to be 47 mg after 3 months. However, a consumer group suspects that actual mean will be less than 47 mg. The consumer group conducted an experiment in which the actual amount of vitamin B₆ was measured for a random sample of twenty 3-month-old pills. The result yielded a mean of 46.94 mg with a standard deviation of 0.15. Assume that the distribution of the amount of vitamin is approximately normal.

(a) What should the consumer group conclude? Conduct a test of hypotheses with a Type I error rate of .05. (15 pts.)

H_0 : _____ vs. H_a : _____

Compute the test statistic and define the rejection rule.

Should the null hypothesis be rejected? Circle one. Yes No

(b) Form a 95% confidence interval for the true mean amount of vitamin B₆ for 3-month-old pills. (10 pts.)

5. A local radio station plays 30 songs between the hours of 1:00 p.m. and 3:00 p.m. every day with no breaks. The mean length of all songs in the play list is $\mu = 225$ seconds and the standard deviation is $\sigma = 40$. The station will randomly select 30 songs from the list and plays them.

(a) What mean play times (in seconds) of 30 songs will result in the total play time exceeding 2 hours? (10 pts.)

(b) Compute the probability that the total play time will exceed 2 hours. (10 pts.)

6. You may choose one of Options A and B below. *Do not answer both.*

Option A: In a large city, 55% of all residents are women, 85% of all residents work fulltime, and, of all the women, 80% work fulltime. Suppose that you select one resident of this city at random.

(a) What is the probability that the selected resident will be a woman who works fulltime? (10 pts.)

(b) What is the probability that the selected resident will be a woman, given that the resident works fulltime? (10 pts.)

Option B: *Similar to the Monty Hall problem.*[†] Alice, Bob, and Chris are the candidates for a job position. The employer notified the candidates that he had randomly chosen one person to hire.

(a) What is the probability that Alice was hired? (10 pts.)

(b) Alice just learned that Chris was not hired. What is the probability that Alice was hired? Briefly explain. (10 pts.)

[†]For the reviewers: Disregard this problem if the Monty Hall problem was not covered in class.

7. Featured below are numbers of soda drinks kids consumed last months. Note that the maximum is 29. Take as given that the sample standard deviation is $s = 8.053$.

Stem	Leaf
0	23
0	57789
1	114
1	7889
2	0
2	89

- (a) Compute the sample mean number of soda drinks. (10 pts.)
- (b) Suppose that you add 3 to each data value. What would the resulting sample mean and sample standard deviation be? No substantial computation is necessary to answer this question. (10 pts.)
8. Numbers of cars parked are counted in the east-side and west-side parking lots of a shopping center for seven days. The manager of the shopping center wishes to know whether the two parking lots are equally crowded.

The obtained data were analyzed using SPSS. The results of the analysis are shown on the following page.

(over)

Figure 1. SPSS output for Problem 8.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	East side	159.71	7	33.584	12.694
	West side	179.71	7	26.500	10.016

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	East side & West side	7	.745	.055

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	East side - West side	-20.000	22.450	8.485	-40.763	.763	-2.357	6	.057

For this analysis, provide a summary of the results. If necessary, use a significance level of .05. (15 pts.)

- State the null and alternative hypotheses.
- Report the test statistic.
- Report the observed significance level.
- State the decision (reject or retain H_0).
- Interpret the results in the context of the problem.