

Name: _____

Directions: This exam contains nine problems worth a total of 120 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. Shown below are shoe sizes (in US measure) for a sample of ten women.

$$X: \{6.0, 9.0, 8.5, 7.5, 8.0, 11.0, 5.0, 7.5, 6.0, 7.0\}$$

- (a) Construct a stem-and-leaf plot using a stem width of 1.0. Comment on the skewness of the distribution of the data. (6 pts.)

- (b) Compute the sample mean and the sample standard deviation. Show your work. (8 pts.)

2. Briefly, but clearly, describe an example of a study in which there is a potential non-response bias. (6 pts.)

3. In 2006, 33% of consumers surveyed said that they would buy a car from a domestic manufacturer. Of that 33%, 31% said that they would choose a GM car.
- (a) Of all the consumers surveyed, what percent of them said that they would choose to buy a GM car? (6 pts.)
- (b) In order for the estimate of the proportion of all consumers willing to buy a GM car to be within .01 of the true value with 90% certainty, how many consumers should be surveyed? (6 pts.)
4. Refer to Problem 3. The same survey revealed that approximately 25% of consumers were willing to buy a foreign car. Suppose that you randomly select 15 people who participated in the survey.
- (a) Find the probability that 5 or more of the 15 people will be willing to buy a foreign car. (8 pts.)
- (b) Find the probability that between 3 and 6 people (inclusive) will be willing to buy a foreign car. (8 pts.)

5. Your neighbor's heating bill in December is normally distributed with a mean of 150 dollars and a standard deviation of 25.
- (a) What is the probability that your neighbor's heating bill will be less than 120 dollars this December? (8 pts.)

 - (b) How much should your neighbor budget each December so that the actual heating bill will exceed the budget only 10% of the time? (8 pts.)
6. For a particular car, when it breaks down, 30% of the time the failure is due to an electrical problem, 60% of the time due to a mechanical problem, and 15% of the time due to both electrical and mechanical problems.
- (a) When this car breaks down, what is the probability that the failure is due to an electrical problem, a mechanical problem, or both? (8 pts.)

 - (b) Are the events "an electrical problem causing the car to break down" and "a mechanical problem causing the car to break down" independent? Justify your answer. (8 pts.)

7. Featured below are numbers of people willing to vote for a Democratic candidate vs. a Republican candidate for the next Presidential election. The survey was conducted in two cities, one in Minnesota and the other in Texas.

Location	Candidate	
	Democrat	Republican
Minnesota	47	31
Texas	50	67

- (a) Conduct a test to determine whether the relative proportions of the people willing to vote for a Democratic candidate vs. a Republican candidate are homogeneous in the two cities. Use $\alpha = .05$. (10 pts.)

H_0 :

H_a :

Compute the test statistic and approximate the p -value.

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

- (b) Does the test conducted in (a) satisfy the assumption about the expected cell counts? Explain. (4 pts.)

8. A random sample of 30 people participated in a simple reaction-time experiment. The sample mean reaction time was 523 milliseconds with a standard deviation of 116.

(a) Estimate the true mean reaction time using a 95% confidence interval. (8 pts.)

(b) At the significance level of .10, conduct a test to determine whether the true mean reaction time is significantly different from 500 milliseconds. (10 pts.)

H_0 : _____ vs. H_a : _____

Compute the test statistic and approximate the p -value.

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

9. A total of 20 adults with weight problems participated in a diet-based weight-loss program. The participants were encouraged to eat healthy foods, such as salads, seafoods, and beans, and to consume less meat and fat for a period of two months. For each participant, the body weight (in pounds) was measured at the beginning of the program (baseline) and at end of the program (follow-up). Two participants withdrew from the program before completion.

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

(over)

Figure 1. SPSS output for Problem 9.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Follow-up	258.39	18	23.119	5.449
	Baseline	269.94	18	26.687	6.290

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Follow-up & Baseline	18	.719	.001

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	Follow-up - Baseline	-11.556	18.974	4.472	-20.991 -2.120	-2.584	17	.019

For this analysis, provide a summary of the results. If necessary, use a significance level of .05. (8 pts.)

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