

Applied Statistics Comprehensive Examination

- Calculators are permitted on this part of the examination.
- When you are asked to construct a confidence interval, always interpret the interval in terms of the problem.
- When you are asked to perform a hypothesis test, always write down the null and alternative hypotheses and write the conclusions in terms of the problem.

1. (20 pts) One hundred political experts are independently asked to predict the winner for three governor races. For all three races, there are only two candidates to choose from. For each expert, the number of correct predictions is recorded, with the following summary of results:

Number of Correct Predictions	0	1	2	3
Frequency	10	41	35	14

Can we conclude at the 0.05 level that the experts performed any differently than would have been expected by chance (i.e. by having each expert flip a fair coin to decide the winners)?

2. (20 pts) A regional restaurant chain recently opened a new location and wants to investigate whether it is worthwhile to offer dessert choices on the menu at this new location. Based on the other restaurants in the chain, they know that more than 8% of customers need to purchase a dessert to make it profitable to offer dessert choices.

- (a) (10 pts) A random sample of 214 customers at the new restaurant is obtained, and 30 of these customers purchase dessert. Find a 95% confidence interval for the true proportion of customers buying dessert at the restaurant. What does the interval indicate regarding whether it would be profitable to offer dessert?
- (b) (10 pts) If in reality 10% of the restaurant's customers buy dessert, based on a sample of 214 customers and an α -level of 0.05, what is the power for concluding the research hypothesis that the true proportion is greater than 8%?

3. (20 pts) Suppose the College Board has developed a new SAT-type test where test scores among college bound students are distributed continuous uniform over the range 0 to 2400.

Recall that the variance of this uniform distribution is $\frac{1}{12}(2400-0)^2=480,000$

- (a) (5 pts) What is the probability that 40 randomly chosen students would have an average score over 1300?
- (b) (15 pts) Suppose that 30 college bound students randomly chosen from those committed to Villanova score an average of 1320. Can we conclude at the 0.01 level that the average score for Villanova-bound students is higher than 1200?

4. (30 pts) A video game company wanted to assess whether there is a difference in how men and women rate the quality of violent computer games. The company also wanted to assess whether the quality rating varied significantly among 10 specific popular computer games labeled as violent by the Entertainment Software Rating Board. Four individuals of each sex were randomly assigned to play each of the 10 games, so that a total of 40 men and 40 women participated in the experiment. Each individual was given game instructions and then asked to play the game for 5 hours in a controlled environment, after which the individual provided a quality rating for the game on a scale from 1 to 100 (100 being the highest quality).

- (a) (10 pts) Write down the analysis of variance model. Clearly define all terms used and state all necessary assumptions.
- (b) (10 pts) Complete the ANOVA table.
- (c) (10 pts) Conduct all appropriate inferences at the 0.05 level.

Source	df	SS	MS	F
Sex		4000		
Game		7300		
Sex × Game		1700		
Residual				
Total		22000		

5. (10 pts) A pharmaceutical company conducted an experiment comparing four different blood pressure medications. For the experiment, 20 patients with high systolic blood pressure were selected and randomly assigned to the four medications. The blood pressure of each patient was measured at the beginning of the experiment and then again a year later. The results for the systolic blood pressure reductions are given below:

Med 1	Med 2	Med 3	Med 4
8	8	20	11
-12	-2	7	27
-2	-1	17	16
-3	14	6	9
4	9	11	15
$\bar{y}_1 = -1.0$	$\bar{y}_2 = 5.6$	$\bar{y}_3 = 12.2$	$\bar{y}_4 = 15.6$
$s_1 = 7.6$	$s_2 = 6.9$	$s_3 = 6.1$	$s_4 = 7.0$

The F-test for whether there is a difference in mean blood pressure reductions among the four medications has p-value 0.008, indicating there are statistically significant differences. Use Fisher's LSD procedure to determine all significant pairwise differences among the means at the 0.05 level.