1. Suppose that in a two-factor ANOVA (with factors A and B), a significant interaction is found. Suppose in addition that the F-test for factor A is significant. The latter result is potentially misleading because:

(a) We must also consider the F-test for factor B.

(b) The value of SSE might be too large.

(c) The levels of factor A may only be significantly different from each other when a particular level of B is used.

(d) We cannot be sure in this case whether or not the sums of squares add up to SST.

(e) Interactions are hard enough to explain without having to explain a significant factor A effect as well.

2. Suppose one is using a χ^2 goodness-of-fit test to test the fit of a particular model that does not completely specify all the unknown parameters. The most *ideal* way to estimate the unknown parameters in this case is to:

(a) Use the sample mean and variance.

(b) Use the method of moments.

(c) Use the method of maximum likelihood.

(d) Use the method of minimum χ^2.

(e) Do so while watching the NFL playoffs.

3. A genetics experiment on characteristics of tomato plants provided the following data on the number of offspring expressing four phenotypes.

Phenotype	Frequency
1 - Tall, cut-leaf	926
2 - Dwarf, cut-leaf	293
3 - Tall, potato-leaf	288
4 - Dwarf, cut-leaf	104
Total	1611

It was of interest to test the following hypothesis, where π_i = the proportion of tomato plants expressing phenotype i, $i = 1, 2, 3, 4$:

$$H_0 : \pi_1 = \frac{9}{16}, \quad \pi_2 = \frac{3}{16}, \quad \pi_3 = \frac{3}{16}, \quad \pi_4 = \frac{1}{16}.$$

The value of the χ^2 statistic for testing this hypothesis is 1.469. Which of the following statements is correct for a test with level $\alpha = 0.1$?

(a) The P-value is greater than 0.1 and so there is enough evidence to conclude that the phenotype proportions differ from those in H_0.

(b) The P-value is greater than 0.1 and so there is not enough evidence to conclude that the phenotype proportions differ from those in H_0.

(c) The P-value is less than 0.1 and so there is enough evidence to conclude that the phenotype proportions differ from those in H_0.

(d) The P-value is less than 0.1 and so there is not enough evidence to conclude that the phenotype proportions differ from those in H_0.

(e) Run for your lives! The killer tomatoes are attacking!

4. The 2008 General Social Survey produced the following count data for $n = 955$ families:

	Marital Happiness		
Income	Not	Pretty	Very
Above	123	105	7
Average	291	151	17
Below	172	83	6

The value of the χ^2 statistic for testing independence of income and marital happiness is 12.84. Which of the following is the correct conclusion for a test with $\alpha = 0.05$?

(a) The P-value is smaller than 0.05 and we therefore conclude that income and marital happiness are independent.

(b) The P-value is smaller than 0.05 and we therefore conclude that income and marital happiness are not independent.

(c) The P-value is larger than 0.05 and we therefore conclude that income and marital happiness are not independent.

(d) The P-value is larger than 0.05 and we therefore conclude that income and marital happiness are independent.

(e) Having a high income is the secret to happiness in marriage.

5. In Small Town, USA, the ages and smoking status of adult residents are distributed as:

		Age		
		18–30	31–45	Over 45
Smoking status	Nonsmoker	2000	3500	3000
	Smokes $<$ one pack a day	400	800	400
	Smokes $\geq$ one pack a day	200	450	150

An adult is randomly selected from Small Town, USA, and it turns out that this adult is *not* a nonsmoker. The probability that this person is between the ages of 31 and 45 is:

(a) $4750/10,900$.

(b) $1250/10,900$.

(c) $450/800$.

(d) $800/1600$.

(e) $1250/2400$.

6. An experimenter investigated the effects of two stimulant drugs, labeled A and B. She had a total of 20 rats, and randomly assigned 4 rats to each of the following five treatment groups: placebo, Drug A low, Drug A high, Drug B low, and Drug B high. Twenty minutes after injection of the drug, each rat's activity level was measured. This led to the following (partially filled) ANOVA table:

Source	df	Sum of squares	Mean square	F
Treatments		181.3		
Within treatments		159.0		
Total	19	340.3		

The value of the F-statistic for testing the hypothesis that the mean activity level is the same for all five treatments is:

(a) 0.534.

(b) 9.72.

(c) 3.192.

(d) 1.140 .

(e) 4.276.

7. In Question **6**, the type of experimental design used is:

(a) A split-plot design.

(b) A randomized block design.

(c) A completely randomized design.

(d) A crossover design.

(e) None of the above.

8. In a simple linear regression analysis, the residuals are:

(a) $y_i - (\hat{\beta}_0 + \hat{\beta}_1 x_i)$, for $i = 1, \ldots, n$.

(b) Used to check whether the variability of y tends to increase with x.

(c) Used to check whether or not the relationship between the response variable y and the independent variable (or covariate) x is linear.

(d) All of the above.

(e) None of the above.

9. In a simple linear regression analysis based on a sample of 100 observations, the 95% confidence interval (CI) for the regression parameter β_1 turned out to be $(0.27, 0.52)$. Then, which of the following is the best and most meaningful interpretation of this CI?

(a) About 95% of the time the true parameter β_1 lies within this interval.

(b) About 95% of the time the parameter estimate $\hat{\beta}_1$ lies within this interval.

(c) If one repeats the data collection process many times and constructs a 95% CI for β_1 each time, then about 95% of these intervals will contain the parameter estimate $\hat{\beta}_1$.

(d) If one repeats the data collection process many times and constructs a 95% CI for β_1 each time, then about 95% of these intervals will contain the true parameter β_1.

(e) About 95% of the time the true response variable lies within this interval.

10. I graded a quiz for 12 students in my class. Their scores (out of 10 points) are as follows:

$$7,\ 5,\ 5,\ 7,\ 7,\ 9,\ 8,\ 6,\ 9,\ 8,\ 6,\ 7.$$

Suppose I want to test the following hypotheses for the median (M) of the population of my students' scores: $H_0 : M = 6.5$ vs. $H_a : M > 6.5$, and suppose I use the Sign test to do so. Then, the Z-statistic and the approximate P-value for this Sign test are closest to:

(a) Z-statistic = -1.1547; P-value $\approx$ 0.125.

(b) Z-statistic = -1.1547; P-value $\approx$ 0.875.

(c) Z-statistic = 1.1547; P-value $\approx$ 0.875.

(d) Z-statistic = 1.1547; P-value $\approx$ 0.125.

(e) Z-statistic = 1.1547; P-value $\approx$ 0.25.