Stat 301 Review (Final)

The final will be broken down as follows:
Approximately 50% new material from chapters 2, 10, 11, 8, and 9.
Approximately 50% old material from chapters 1, 2, 3, 7, 12 and 13.

Here is a checklist broken down by section:

Section	**Concept**	**Check List**
Graphs	• Know which graph to use given a word problem. • Know how to describe your data based on a given graph. Are there any outliers or gaps? Is it symmetric, skewed left or right? Is it unimodal or bimodal? Where is the center of the distribution?	
Numerical Summaries	• Know which numerical summaries are most useful based on the shape of the distribution of your data. • Know which numerical summaries work best together. • Understand the concept of a resistant measure (know the definition as well as the measures which are resistant).	
Data collection	Vocabulary / concepts: • Anecdotal evidence • Available data • Unit • Population • Sample • Census • Observational study versus experiment • Experimental unit • Subjects • Treatments • Factors / Factor levels • Placebo • Control group • Statistical significance • Three principles of experimental design • Know how to randomize • Problems versus advantages of experiments • Non random sampling • Random sampling • Sampling bias • Undercoverage • Nonresponse • Response bias	

	- Parameter - Statistics - Sampling variability - Sampling distribution of a statistic - How population size affects the sampling variability of a statistic - Ethics of doing experiments with humans and animals.	
Experimental Designs	Designs: Do not just study the definitions of these three designs. You will need to be able to read a problem and determine which type of design was used. You will also need to know how to diagram the design. - Completely randomized design - Randomized block design - Matched pairs	
Sampling Designs	Designs: Do not just study the definitions of these designs. You will need to be able to read a problem and determine which type of sampling was used. - Voluntary response sample - Simple random sample - Stratified random sample - Multistage sample - Capture-recapture sample	
Ch. 7	- What kind of stories and graphs go with a t-test/confidence interval for the one-sample mean, matched pairs, 2-sample comparison of means? - When it is better to calculate a confidence interval versus conduct a hypothesis test.	
Ch. 12	What kind of stories and graphs go with a one-way ANOVA problem.	
Ch. 13	What kind of stories and graphs go with a two-way ANOVA problem.	
Ch. 8	- Know how to do confidence intervals for both one and two sample proportion problems. - Know how to do hypothesis tests for both one and two sample proportion problems. - Know when it is appropriate to use the formulas in these chapters.	
Ch. 9 and Section 2.5	- Given a two-way table, find the joint distribution of categorical variables. - Given a two-way table, find the marginal distribution of categorical variables. - Given a two-way table, find the conditional distribution of categorical variables. - Given a two-way table, find the joint, marginal and conditional probabilities. - Relationship between a χ^2 test and a two sample proportion test. - Do a hypothesis test for a χ^2 test.	

	• Know when it is appropriate to use a χ^2 test.	
Ch. 2 and 10	• Know how to interpret a Normal probability plot, scatterplot, and residual plot. • Use SPSS output to find the following: least-squares regression line, correlation, r^2, and estimate for σ. • Find the predicted response and residual for one of the sets of data. • Use SPSS to find the prediction interval. • Hypothesis test for the regression slope (state the null and alternative hypothesis, obtain the test statistic and *P*-value from SPSS output and state your conclusions in terms of the problem). • Test for zero population correlation (state the null and alternative hypothesis, calculate the test statistic and find the *P*-value and state your conclusions in terms of the problem. • Outlier versus influential variables. • Common response versus confounding. • Causation.	
Ch. 11	• Use SPSS output to find the following: Least-squares regression line, correlation, r^2, and estimate for σ. • Use the least-squares regression line for prediction. • The F test (state the null and alternative hypothesis, calculate the test statistic and find the *P*-value from the SPSS output and state your conclusions in terms of the problem.) • Know how to determine which explanatory variables should be included in a model (significance tests for β_j)	
Ch. 6-13	ALL hypothesis tests and confidence intervals give you information about the POPULATION parameter. When writing your conclusion to a hypothesis test, be sure to include the word "population."	

1-sample proportion	• One percent or proportion. • **Categorical data**	$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$, where $\hat{p} = \frac{x}{n}$ To find the z* value, look at the last row of the *t*-table.	Hypotheses: $H_0 : p = p_0$ versus $H_a : p > p_0$, $H_a : p < p_0$ or $H_a : p \neq p_0$ Test Statistic: $z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$ *P*-value: $H_a : p > p_0$, use $P(Z > z)$, $H_a : p < p_0$, use $P(Z < z)$ or $H_a : p \neq p_0$, use $2P(Z > \|z\|)$ Look up *P*-values on Normal table
2-sample proportion	• Two percents or proportions are compared. • **Categorical data**	$(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$, where $\hat{p}_1 = \frac{x_1}{n_1}$ and $\hat{p}_2 = \frac{x_2}{n_2}$ To find the z* value, look at the last row of the *t*-table.	Hypotheses: $H_0 : p_1 = p_2$ versus $H_a : p_1 > p_2$, $H_a : p_1 < p_2$ or $H_a : p_1 \neq p_2$ Test Statistic: $z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ **Note:** $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$ *P*-value: $H_a : p_1 > p_2$, use $P(Z > z)$, $H_a : p_1 < p_2$, use $P(Z < z)$ or $H_a : p_1 \neq p_2$, use $2P(Z > \|z\|)$ Look up *P*-values on TABLE A
χ^2 **test**	• Two categorical variables are compared. • **Categorical data**	Know how to calculate marginal, joint, and conditional distributions/percentages. Know when it is appropriate to use the chi-square test (check the footnote below the output).	Hypotheses: H_0 : There is no relationship between A and B H_a : There is a relationship between A and B Test statistic: Read χ^2 value from the printout. *P*-value: Read *P*-value from the printout.

The problems below have been taken from old finals:

MATCHING: For problems 1-10, write the letter of the most appropriate statistical analysis technique next to the story.
Note: each answer choice may be used once, more than once, or not at all.

_____ 1. Is there a significant average difference between Wednesday and Saturday gas prices if we check these 20 stations on both days?

_____ 2. What is the median gas price for Lafayette gas stations?

_____ 3. Does the number of insurgent attacks in the war in Iraq affect gas prices on a weekly basis?

_____ 4. Will the percentage of people traveling by plane be higher on Memorial Day weekend or Labor Day weekend?

_____ 5. Do region of the country and weather forecast (sunny, cloudy, rainy) have an effect on the population average grocery bill for households on Memorial Day weekend?

_____ 6. Are region of the country and size of vehicle (small car, large car, truck, SUV) associated?

_____ 7. Is there a significant difference between the average Indiana gas price and the average California gas price today if 20 stations in each state are sampled?

_____ 8. Is there a difference in the average number of times a month a driver fills up his tank for drivers of small cars, large cars, trucks, and SUVs?

_____ 9. I want to predict the number of people who will travel on Memorial Day this year by looking at gas prices, temperatures, unemployment rates, consumer price indices, and presidential approval percentages over the past 30 years.

_____ 10. Is the average gas price for Indiana stations last Wednesday less than $2.15?

A. Mean and/or standard deviation

B. Five number summary

C. Simple linear regression

D. Multiple linear regression

E. 1-sample mean t-test

F. Matched pairs t-test

G. 2-sample (Comparison of means) t-test

H. 1-sample proportion Z-test

I. 2-sample proportion Z-test

J. Chi-squared test

K. One-way ANOVA

L. Two-way ANOVA

For questions 11-15, **choose the letter for the graph** listed below which would be appropriate for answering the questions. Each letter may be used once, more than once, or not at all.

A. Scatterplot **B. Side-by-side boxplots** **C. Histogram** **D. Pie Chart**

_____ 11. What is the percentage of Indiana vehicles which are small passenger cars, large passenger cars, trucks, SUVs, and other?

_____ 12. Is there much difference between the gas mileage of small passenger cars, large passenger cars, trucks, and SUVs?

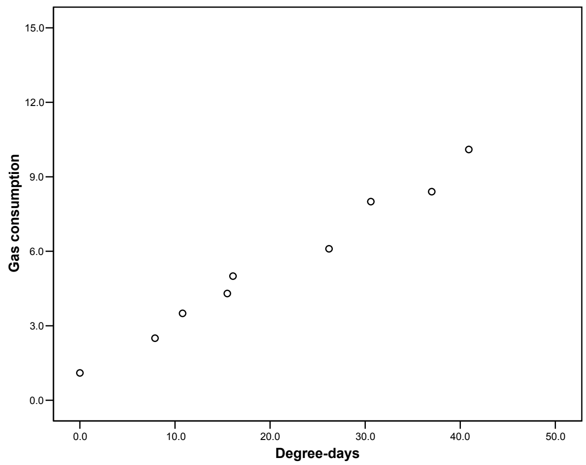
_____ 13. Are gas prices and daily high temperature independent?

_____ 14. Is there a negative association between the number of hybrid cars registered to a state and the number of people who voted for George W. Bush in the election?

_____ 15. Is the distribution of people per state who own hybrid cars symmetric or skewed?

16. Alex is a homeowner and is concerned about heating costs. He feels the outside temperature has an impact on the amount of gas used to heat his house. So he looks on the website www.weather.com and finds the temperatures for each day and determines the average degree days per month. He finds his heating bill and records the gas consumption for each month. Below is a record of the results and the output after he entered the data into SPSS.:

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Degree-days	16.1	26.2	37.0	40.9	30.6	15.5	10.8	7.9	0.0
Gas consumption	5.0	6.1	8.4	10.1	8.0	4.3	3.5	2.5	1.1



Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.991(a)	.983	.980	.4162

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	68.990	1	68.990	398.345	.000(a)
	Residual	1.212	7	.173		
	Total	70.202	8			

a Predictors: (Constant), Degree-days
b Dependent Variable: Gas consumption

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.094	.258		4.235	.004	.483	1.705
	Degree-days	.212	.011	.991	19.959	.000	.187	.237

a Dependent Variable: Gas consumption

a. What is the explanatory variable?

b. What is the response variable?

c. Describe the form, strength, and direction of the relationship.

d. What is the equation of the least squares regression line for the heating season?

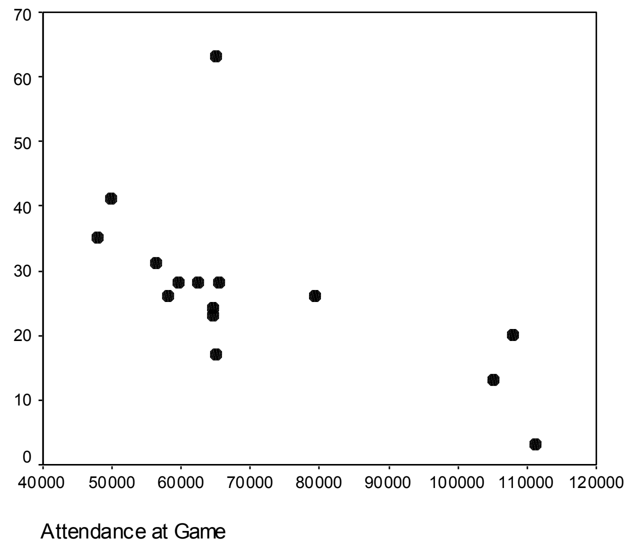
e. What is the predicted gas consumption when degree-days is 30.6?

f. Find the residual value when degree days is 30.6.

g. How much of the variation in gas consumption is explained by the least-squares regression?

h. Do a test to determine if there is a linear relationship between degree-days and gas consumption. State your hypotheses, test statistic, P-value, and your conclusion in terms of the story.

17. As an avid supporter of Purdue's football team, Pete wants to do a little analysis. He took a random sample of 15 games from the last three seasons. He thinks that the number of fans at each game may affect the number of points Purdue scores. The output from his analysis is below:



Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.611[a]	.373	.325	11.028

a. Predictors: (Constant), Attendance at Game

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	942.048	1	942.048	7.747	.016[a]
	Residual	1580.886	13	121.607		
	Total	2522.933	14			

a. Predictors: (Constant), Attendance at Game

b. Dependent Variable: Points Purdue Scored

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95% Confidence Interval for B Lower Bound	95% Confidence Interval for B Upper Bound
1	(Constant)	55.233	10.513		5.254	.000	32.522	77.945
	Attendance at Game	−0.000397	.000	-.611	-2.783	.016	-.001	.000

a. Dependent Variable: Points Purdue Scored

a. What is the explanatory variable?

b. What is the response variable?

c. Describe the form, strength, and direction of the relationship.

d. What is the equation of the least squares regression line for the number of points scored?

e. What is the predicted number of points scored when the attendance is 56,400?

f. When the attendance was 56,400, Purdue scored 31 points. What is its residual?

g. How much of the variation in number of points scored by Purdue is explained by the least-squares regression?

h. Do a test to determine if there is a negative linear relationship between attendance at games and number of points scored by Purdue. State your hypotheses, test statistic, P-value, and your conclusion in terms of the story.

18. After thinking some more, Pete thought there could be other variables that might affect the number of points Purdue scored. One variable of interest is the number of points the opponent scores. He added this variable to his analysis and did a multiple regression.

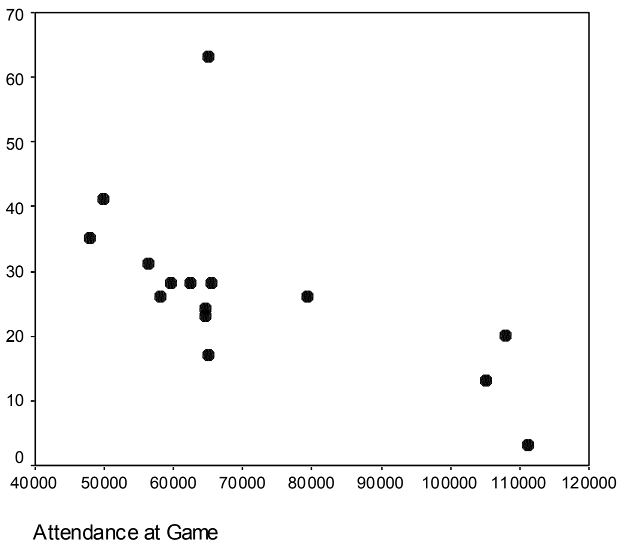
   a. Using the output on the next four pages, what is the best equation of a line for predicting the number of points Purdue scored in a game? (use $\alpha = 0.1$)

   b. Give 4 reasons for why you made that choice.

Correlations

		Points Purdue Scored	Attendance at Game	Points Opponents Scored
Points Purdue Scored	Pearson Correlation	1	-.611*	.075
	Sig. (2-tailed)	.	.016	.790
	N	15	15	15
Attendance at Game	Pearson Correlation	-.611*	1	-.157
	Sig. (2-tailed)	.016	.	.576
	N	15	15	15
Points Opponents Scored	Pearson Correlation	.075	-.157	1
	Sig. (2-tailed)	.790	.576	.
	N	15	15	15

*. Correlation is significant at the 0.05 level (2-tailed).


70
60
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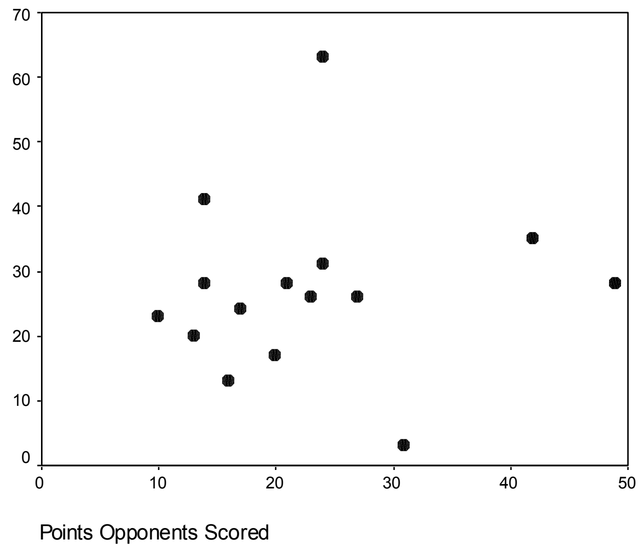
Attendance at Game


70
60
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40
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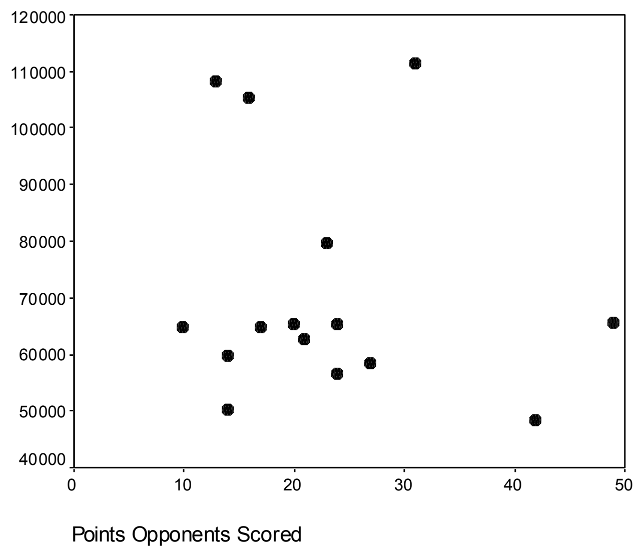
40
50
Points Opponents Scored


120000
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90000
80000
70000
60000
50000
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0
10
20
30
40
50
Points Opponents Scored

SPSS output for using POINTS OPPONENTS SCORED and ATTENDANDCE AT GAME to predict POINTS PURDUE SCORED:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.611[a]	.374	.269	11.474

a. Predictors: (Constant), Points Opponents Scored, Attendance at Game

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	943.174	2	471.587	3.582	.060[a]
	Residual	1579.759	12	131.647		
	Total	2522.933	14			

a. Predictors: (Constant), Points Opponents Scored, Attendance at Game

b. Dependent Variable: Points Purdue Scored

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	55.997	13.704		4.086	.002
	Attendance at Game	-3.99E-04	.000	-.614	-2.656	.021
	Points Opponents Scored	-2.65E-02	.286	-.021	-.093	.928

a. Dependent Variable: Points Purdue Scored

SPSS output for using just ATTENDANDCE AT GAME to predict POINTS PURDUE SCORED:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.611[a]	.373	.325	11.028

a. Predictors: (Constant), Attendance at Game

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	942.048	1	942.048	7.747	.016[a]
	Residual	1580.886	13	121.607		
	Total	2522.933	14			

a. Predictors: (Constant), Attendance at Game

b. Dependent Variable: Points Purdue Scored

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	55.233	10.513		5.254	.000	32.522	77.945
	Attendance at Game	−0.000397	.000	-.611	-2.783	.016	-.001	.000

a. Dependent Variable: Points Purdue Scored

SPSS output for using just POINTS OPPONENTS SCORED to predict POINTS PURDUE SCORED:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.075[a]	.006	-.071	13.892

a. Predictors: (Constant), Points Opponents Scored

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.204	1	14.204	.074	.790[a]
	Residual	2508.729	13	192.979		
	Total	2522.933	14			

a. Predictors: (Constant), Points Opponents Scored

b. Dependent Variable: Points Purdue Scored

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	24.931	8.649		2.882	.013
	Points Opponents Scored	9.284E-02	.342	.075	.271	.790

a. Dependent Variable: Points Purdue Scored

19. An environmental health professor conducted a study to see whether fast-food workers wearing gloves actually lowers the chance that customers will come down with food poisoning. The scientists purchased 371 tortillas from several local fast-food restaurants, noting whether the workers were wearing gloves or not. 190 of the tortillas came from bare-hands restaurants; 181 of the tortillas came from glove-wearing restaurants. The scientists then tested the tortillas purchased for microbe growth. They found that the bare-hands restaurants' tortillas gave rise to microbe growth on 18 tortillas, and the glove-wearing restaurants' tortillas gave rise to microbe growth only on 8 tortillas. Is the glove-wearing restaurants' tortillas' microbe growth significantly lower than the bare-hands restaurants' microbe growth at the 5% significance level?

    1. State your hypotheses for this test.

    2. Calculate your test statistic.

    3. Find your P-value.

    4. State your conclusion in terms of the story.

20. In a 1984 survey of licensed drivers in Wisconsin, 214 of 1200 men said that they did not drink alcohol. Construct a 95% confidence interval for the proportion of men who said that they did not drink alcohol. Is your confidence interval calculation reasonable? Why?

21. On the next page is the SPSS output for a study of alcohol and nicotine consumption among 452 pregnant women. Nicotine consumption is divided into 3 categories, and alcohol consumption is divided into 4 categories. Answer the questions below based on the output that follows.

    a. What proportion of the non-alcohol consuming women do not smoke during pregnancy? Is this a joint, marginal or conditional probability?

    b. What proportion of women do not smoke and do not consume alcohol during pregnancy? Is this a joint, marginal or conditional probability?

    c. Find the marginal distribution for alcohol consumption during pregnancy.

    d. State the null and alternative hypotheses to test whether there is a relationship between alcohol consumption and smoking during pregnancy.

    e. What are the test statistic and P-value used to test the hypotheses in part d?

    f. State your conclusions in terms of the original problem.

    g. Are your results for the above test valid? Explain your answer.

Alcohol * Nicotine Crosstabulation

Count

		Nicotine			
		1-15	16 or more	None	Total
Alcohol	.01-.10	5	13	58	76
	.11-.99	37	42	84	163
	1.0	16	17	57	90
	None	7	11	105	123
Total		65	83	304	452

Note: Nicotine is measured in milligrams/day and alcohol in ounces per day.

Alcohol * Nicotine Crosstabulation

			Nicotine			
			1-15	16 or more	None	Total
Alcohol	.01-.10	Count	5	13	58	76
		Expected Count	10.9	14.0	51.1	76.0
		% of Total	1.1%	2.9%	12.8%	16.8%
	.11-.99	Count	37	42	84	163
		Expected Count	23.4	29.9	109.6	163.0
		% of Total	8.2%	9.3%	18.6%	36.1%
	1.0 or more	Count	16	17	57	90
		Expected Count	12.9	16.5	60.5	90.0
		% of Total	3.5%	3.8%	12.6%	19.9%
	None	Count	7	11	105	123
		Expected Count	17.7	22.6	82.7	123.0
		% of Total	1.5%	2.4%	23.2%	27.2%
Total		Count	65	83	304	452
		Expected Count	65.0	83.0	304.0	452.0
		% of Total	14.4%	18.4%	67.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.252[a]	6	.000
Likelihood Ratio	44.653	6	.000
N of Valid Cases	452		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.93.

Multiple Choice: Circle the letter of the correct answer and write its letter in the blank next to each story.

_____ 22. Does bread lose its vitamins when stored? Twenty small loaves of bread were randomly assigned to one of four storage times (one, two, three, or four days). After the bread had been stored for its respective amount of days, its vitamin C content was measured. This is an example of a

A. simple random sample.
B. completely randomized design.
C. randomized block design.
D. matched pairs design.
E. stratified random sample.

_____ 23. The department of health wanted to know how many people received flu shots this year. They thought that females were more likely to get a shot, so they randomly selected 500 males and 500 females in Lafayette and West Lafayette to survey. This is an example of a

A. simple random sample.
B. completely randomized design.
C. randomized block design.
D. matched pairs design.
E. stratified random sample.

_____24. Which of the following is a potential way to reduce sampling variability?

A. Increase your sample size.
B. Decrease your sample size.
C. Increase your population size.
D. Decrease your population size.

For questions 25-27, **choose the letter for the type of bias** listed below which is a problem in the story**.**

A. Undercoverage **B. Nonresponse** **C. Response bias**

_____25. John wanted to find out people's opinions regarding Greater Lafayette Health Services' desire to build a new hospital. Consequently, he took a simple random sample of 500 Lafayette and West Lafayette residents listed in the phone book. He is concerned however that those not listed in the phone book may have different views. What type of bias is he concerned about?

_____26. When John attempted to collect data from those who made it into his sample, he was unable to contact some of them and others refused to answer his survey questions. What type of bias could this produce?

_____27. John was pleased with the unanimous response to his survey question which read "Do you believe that building a new hospital is a waste of recourses and will leave two perfectly good buildings vacant?" What type of bias could his survey question be producing?

For questions 28-31, **choose the letter for the graph** listed below which would be appropriate for answering the questions. Each letter may be used once, more than once or not at all.

A. Scatterplot **B. Side-by-side boxplot** **C. Histogram** **D. Bar graph**

______28. Compare the percentage of Lafayette residents who feel that a new hospital should be built with the percentage that don't feel that a new hospital should be built and the percentage who don't care.

______29. Is the distribution of people's ages who feel a new hospital should be built in Lafayette symmetric or skewed?

______30. Is there a positive association between the age and number of times a Lafayette resident visits one of the hospitals in a year?

______31. Is there a difference in the average number of hospital visits per year between Lafayette residents that would like to see a new hospital built and those who would not or don't care?

MATCHING: For problems 32-41, write the letter of the most appropriate statistical analysis technique next to the story.
<u>Note</u>: each answer choice may be used once, more than once, or not at all.

_____ 32. As the outdoor temperature (in degrees) increases, do ice cream sales (in dollars) increase at the Silver Dipper?

_____ 33. Is there a significant average difference between soft-serve and hard-packed ice cream if we check the prices of both at 20 different ice cream parlors?

_____ 34. Do high school students spend more money on ice cream on average than college students?

_____ 35. Is the average number of scoops of ice cream a person eats in a summer week less than 5?

_____ 36. Does a person's favorite flavor (triple chocolate, chunky monkey, or vanilla) or residential proximity to an ice cream parlor (reported only as less than 1 mile, between 1 and 5 miles, or more than 5 miles) or their interaction have an effect on the amount of money a person spends on ice cream in a summer?

_____ 37. Can a person's age, residential proximity to an ice cream parlor (reported in miles), and IQ do a good job of predicting how many ice cream cones that person will eat in a summer?

_____ 38. Is there a significant difference between how many ice cream cones a year on average freshmen, sophomores, juniors, and seniors eat?

_____ 39. What is the maximum price for ice cream cones if I look at prices of single scoop cones from 25 different stores?

_____ 40. Is there a relationship between a person's favorite flavor of ice cream (triple chocolate, chunky monkey, or vanilla) and their gender?

_____ 41. Is the percentage of men who like triple chocolate ice cream the best higher than the percentage of women who like triple chocolate ice cream the best?

A. Mean and/or standard deviation

B. Five number summary

C. Simple linear regression

D. Multiple linear regression

E. 1-sample mean t-test

F. Matched pairs t-test

G. 2-sample (Comparison of means) t-test

H. 1-sample proportion Z-test

I. 2-sample proportion Z-test

J. Chi-squared test

K. One-way ANOVA

L. Two-way ANOVA

42. A local news station reported that 72% of all people push the snooze button at least once before waking up in the morning. Pete, an engineering student at Purdue, thought that since engineering students are usually up late studying, a higher percentage of engineers would push the snooze button. He decides to take a sample of 50 engineering students and found that 39 said they push the snooze button each morning. Is the true percentage of people who push the snooze button at least once in the morning significantly higher than the news station's report? (use $\alpha = 0.1$)

a. State the hypotheses for this test.

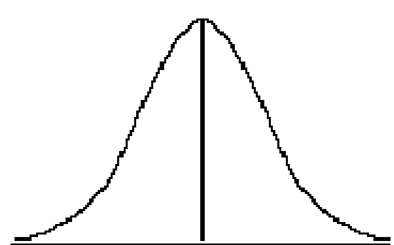
b. Calculate the test statistic.

c. Find the P-value.

d. State your conclusion in terms of the story.

e. Construct a 90% confidence interval for the proportion of engineering students who push the snooze button.

f. On the curve below insert and clearly label the p_0, the $\hat{p}$, and the P-value for the hypothesis test in parts a through d above.



43. Is there a relationship between cigarette smoking and drinking? With the recent proposed ordinance for West Lafayette peaking his interest, an interested citizen selected a SRS of Purdue students, surveyed those students, and got the results summarized below.

Alcoholic drinks per week * Cigarettes smoked per day Crosstabulation

Count

		Cigarettes smoked per day				
		None	1-10	11-20	21+	Total
Alcoholic drinks per week	None	185	90	98	43	416
	1-2	64	50	45	19	178
	3-5	57	37	40	25	159
	6+	89	57	61	40	247
Total		395	234	244	127	1000

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.845[a]	9	.170
Likelihood Ratio	12.598	9	.182
Linear-by-Linear Association	7.527	1	.006
N of Valid Cases	1000		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.19.

a. If a student has no drinks per week, what is the probability he/she smokes no cigarettes? Is this a joint, marginal, or conditional probability?

b. Determine if the amount of drinking and cigarette smoking are related. State your hypotheses, your test statistic, your P-value, and your conclusion in terms of the story.

c. Was it appropriate to do the test in part b? Justify your answer.