(8 points : 8 minutes)

1. **You make wood products with glue to fasten joints together. The manufacturer of a new glue formula claims that wood joints using the new glue can hold on average 10 pounds more than joints that use the old formula. You make 14 joints using the new glue and 11 joints using the old glue, then you measure how much weight each joint can hold. Use the results below to test the glue manufacturer's claim.** (Use $\alpha = 0.10$ for the test and assume that variation is about the same for both glues.)

	Weight Held	
	New Glue	Old Glue
$\bar{x}$ =	201.0	178.4
s =	10.3	9.0
n =	14	11

(8 points : 8 minutes)

Use the results of the experiment below to test whether the population correlation (ρ) is negative. If you cannot figure out how to get the sample correlation coefficient quickly, use r = - 0.32. (For this test, use α = 0.025).

Experiment results:

regression line:

intercept =	**0.0**
slope =	**0.00**
S_e =	**0.00**
n =	**24**
S_Y =	**0.00**

(8 points : 8 minutes)

9. A company makes complicated laboratory equipment for analyzing chemical samples. To learn about the performance of their machines, the company works with 9 laboratories and gives to each four (4) identical sample of material to analyze, so a total of 36 measurements are taken.

Variability in the outcomes of all 36 tests represents differences between laboratories (laboratory is considered the "treatment") and differences from test to test within the same laboratory ("error"). Complete the Analysis of Variance table below and carry out the appropriate hypothesis test to decide whether the expected (mean) results are the same for all 9 laboratories.
(Use a significance level of 0.04 for this test.)

Analysis of Variance Table

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	p-value
Laborator			47.2		0.0297
Error					
Total	866.3				

(6 minutes : 6 points)

3. **An experiment was done to examine the relationship between measurements of "X" and measurements of "Y". Use the data reported in the box to test the proposition that X and Y are positively correlated.**
   (Use α = 0.025 for the test.)

Data from the Experiment

X	Y
435	388
302	394
332	306
457	450
442	436

(6 minutes : 7 points)

4. **You make wood products with glue to fasten joints together. The manufacturer of a new glue formula claims that wood joints using the new glue can hold on average 10 pounds more than joints that use the old formula. You make 8 joints using the new glue and 15 joints using the old glue, then you measure how much weight each joint can hold. Use the results below to make a 95% confidence interval for (μ_{NEW} - μ_{OLD}), and then answer the question below. Experts advise you that the strength of joints made with the old glue appears to be more variable than with the new glue.**

	Weight Held	
	New Glue	Old Glue
$\bar{x}$ =	215.0	198.4
s =	4.4	9.3
n =	8	15

(8 points : 12 minutes)

6. **The form (tablets or liquid) of a sleeping aid medication may affect the speed at which the medication works. Use the results of the experiment below to test the claim that the average amount of time elapsed time) before patients fall asleep is 5 minutes longer for tablets than for liquid. It is interesting but not especially important that the variation in time was about the same for both tablets and liquid. The six patients who participated in the study did not like the flavor of the liquid.**
(Use a 0.05 significance level for this test.)

H_0: ______________________

H_1: ______________________

Elapsed Time Before Sleep f		
Patient	**Tablet**	**Liquid**
1	30.4	28.2
2	18.0	17.3
3	29.1	25.7
4	19.2	17.7
5	23.9	23.6
6	22.5	19.1
$\bar{x}$ =	23.85	21.93
s =	5.06	4.55
n =	6	6

(6 points : 7 minutes)

7. **A company makes a sleep aid medication. They are interested in making a liquid version of their popular tablets, but some patients say liquid formulas usually taste bad. Use the following data to prepare a 98% confidence interval for the difference between the proportion of taste testers who say that Formula "A" tastes "bad" and the proportion of taste testers who say Formula "B" tastes "bad".**

	Taste Test Result		
	Good	**Bad**	**Total**
Formula A	387	13	400
Formula B	354	46	400

(8 points : 10 minutes)

8. **A company makes a sleep aid medication. They are concerned that alcohol use may interfere with the medications effectiveness, so that people who drink take longer to fall asleep. Use the data below to test whether the time needed to fall asleep after taking the medication is independent of a person's level of alcohol use.**

Amount of daily alcohol use	Minutes needed before sleep 0-10	10-20	20-30	Total
none	117	269	114	500
1 to 2 drinks	90	240	170	500
3 or more drinks	82	239	179	500
Total	289	748	463	1500

(7 points : 10 minutes)

10. **A major news organization is interested in the public issues that registered voters think are most important. A stratified random sample of 320 registered voters is selected to represent the whole population of voters. Each voter is asked to select from a list of 8 issues the one that is most important. Compare the results to see if they are significantly different from the proportions expected by the news organization that carried out the study.** (Let α be 0.05 for the test.)

H_0: ______________________

____

H_0: ______________________

____

Issue	Proportions Expected	In Sample
Traffic Congestion	10%	30%
Pollution	10%	5%
Taxes	10%	25%
Deficits	10%	5%
Death Penalty	5%	5%
Iraq War	25%	20%
Education	10%	5%
Health Care	20%	5%

(8 points; 10 minutes)

3. **Create a 90% confidence interval for the difference between the two population means represented by the means of the two samples.** (Assume that variation is the same for both populations.)

	A	B
	135	90
	86	110
	95	130
	85	98
	167	80
	93	113
	94	
	131	
	119	
average	111.7	103.5
st. dev.	28.2	17.9
n	9	6

Based on your confidence interval, is it reasonable to claim that μ_B is 102 and μ_A is 113?

YES **NO** **Why?**

____

____

(8 points; 10 minutes)

4. **Use the data on personal net worth and happiness scores for a random sample of 6 people to test the claim that net worth and happiness are positively correlated.** (Let $\alpha = 0.05$ for this test.)

Person:	1	2	3	4	5	6
Net worth*:	65	120	127	131	190	83
Happiness:	7	4	7	10	7	1

* in $1000's

Claim: ______________________________

H_0: ______________________________

H_1: ______________________________

(8 points; 10 minutes)

5. **Use the information in the contingency table to decide whether or not to reject the claim that Factor A and Factor B are independent. Let α = 0.05 for this test.**

Level of Factor B	Level of Factor A 1	2	3	Row Total
1	66	68	66	200
2	55	83	62	200
3	43	88	69	200
Column Total	164	239	197	600

Claim: ______________________

____

H_0: ______________________

____

H_1: ______________________

____

(10 points : 10 minutes)

10. **A maker of tires for cars believes a new design will wear longer than the current design. Four of the new tires are prepared. Four cars are used in an experiment where one tire of the old design and one of the new design are used on the front wheels of each car. Use the data below to test the manufacturer's claim that the new design will increase the miles of wear by more than 500 miles.** (Use a 0.10 significance level for the test.)

Miles of Wear per Tire

Car	Old Design	New Design
1	58500	59100
2	60100	60700
3	58500	59200
4	63400	63800

(10 points; 10 minutes)

8. **Use the survey results below to test the claim that the eight issues listed are equally ranked as most important by voters in the region of the survey. The sample was selected at random from the list of all registered voters.** Let $\alpha = 0.025$.

Claim: ______________________

____

H_0: ______________________

____

H_1: ______________________

____

Issue	**Count**
Taxes	**87**
Education	**105**
Security	**96**
Poverty	**108**
Transportation	**114**
Environment	**104**
Immigration	**87**
Social Security / Medicare	**99**
Total =	**800**

(7 points; 8 minutes)

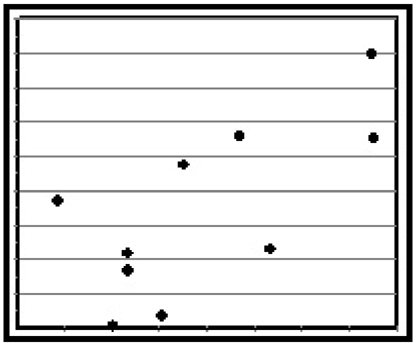
9. **A random sample of 50 houses valued at more than \$300,000 found 12% with significant health hazards, while a random sample of 46 homes valued at less than \$100,000 found 17.4% with significant health hazards. Create a 95% confidence interval for the difference between the the proportions of the two populations from which the samples came.**

(3 points, 5 minutes)

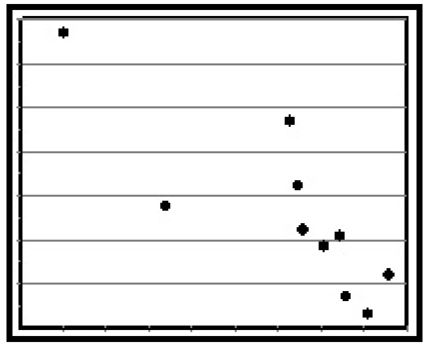
8. Assign one of the following correlation coefficients to each of the graphs to the right.
(or state r = none if no correlation coefficient seems appropriate for a graph)

r
-0.85
0.00
0.70

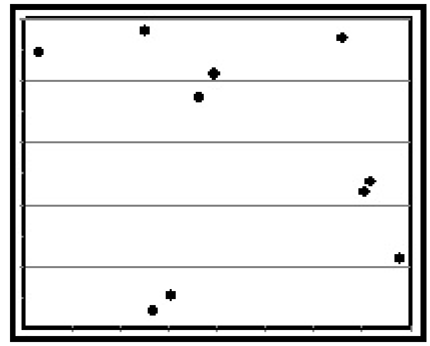
r = _________



r = _________



r = _________

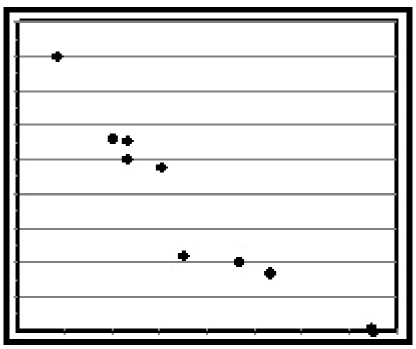


(3 points, 5 minutes)

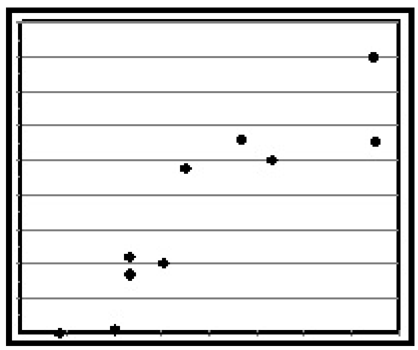
9. Assign one of the following correlation coefficients to each of the graphs to the right.
(or state r = none if no correlation coefficient seems appropriate for a graph)

r
1.00
0.90
-1.10

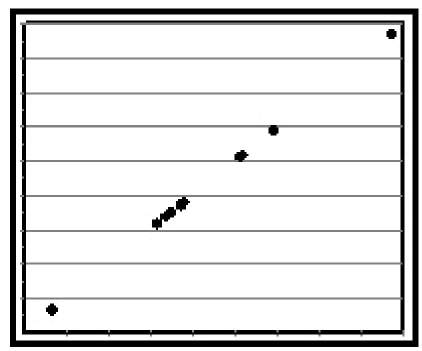
r = _________



r = _________



r = _________

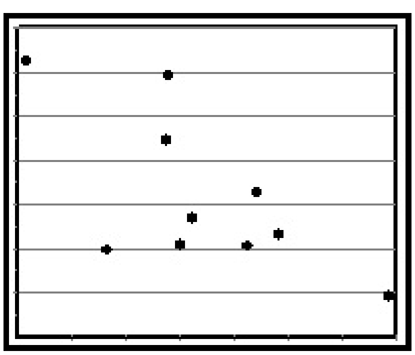


(3 points, 5 minutes)

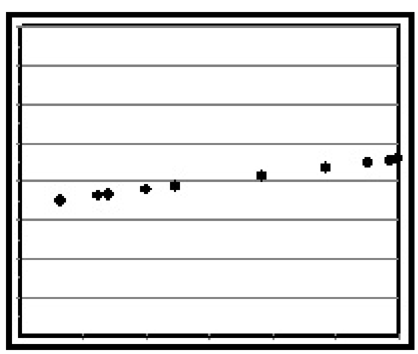
10. Assign one of the following correlation coefficients to each of the graphs to the right.
(or state r = none if no correlation coefficient seems appropriate for a graph)

r
-0.70
0.00
0.90

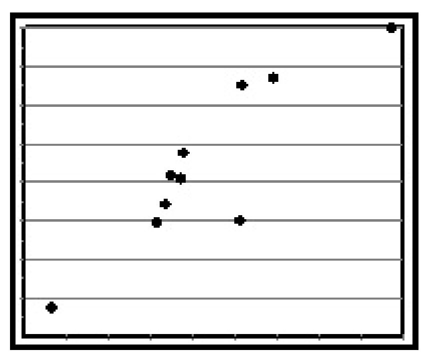
r = _________



r = _________



r = _________



(8 points - 15 minutes)

1. **Use the data given here to test the claim that the linear correlation between fuel economy (miles per gallon) and speed (miles per hour) is negative. Assume the test vehicles were selected at random.**
   (Use α = 0.01 and do not use Table A.6)

Claim: ____________________

H_0: ____________________

H_1: ____________________

Vehicle	(X) Speed (mi/hr)	(Y) Fuel Economy (mi/gal)
1	26	30.7
2	34	22.7
3	39	19.0
4	58	23.8
5	61	15.5
6	78	17.5

(6 points - 10 minutes)

2. **Would the conclusion of your test change if the correlation were the same but the sample had included 28 vehicles? Do not answer just "yes" or "no". Prove your case.**

(10 points - 15 minutes)

3. **The proportions of people in the U.S. that prefer 5 different kinds of entertainment are shown in the table below. A local survey of 600 people found 60 people who prefer movies, 300 who prefer to watch TV, 90 who like to listen to music, 30 who prefer dancing, and 120 that prefer to play sports. Test the claim that the true local proportions are the same as the national rates.** (Use a 0.05 significance level for the test)

Claim: ______________________________

H_0: ______________________________

H_1: ______________________________

Preferred Entertainment	National Rates	Local Survey Count
Watching Movies	0.15	60
Watching Television	0.35	300
Listening to Music	0.10	90
Dancing	0.10	30
Playing Sports	0.30	120
	Survey Total =	600

(10 points - 20 minutes)

4. **Use the data in the table to test the idea that the use of some "slang" terms is independent of age. The data represent a stratified random sample of 400 people from Los Angeles.**
   (Use α = 0.025 for this test)

Most used Slang Term	**Age Group** 10 to 20	21 to 40	41 to 60	> 60	**Total**
"I'm like ... "	**88**	**50**	**10**	**2**	**150**
"totally"	**10**	**40**	**40**	**10**	**100**
"far out"	**2**	**10**	**50**	**88**	**150**
Total	**100**	**100**	**100**	**100**	**400**

Claim: ______________________________

H_0: ______________________________

H_1: ______________________________

(6 points; 8 minutes)

12. Two random samples of arthritis pain sufferers are treated with pain relieving creams. The first sample of people use "Cream A" and the second sample of people uses "Cream B". Use the results below to construct a 98% confidence interval for the difference between the proportions of people who reported that the cream they used made the pain less.

	Cream A	Cream B
Less Pain	38	51
Not less	12	9
Total	50	60

(7 points; 8 minutes)

13. A random sample of arthritis pain sufferers is treated with two pain relieving creams. Each person uses "Cream A" for a month and "Cream B" for a month (in a random order). Use the data below to test the claim that "Cream B" relieves pain better than "Cream A".
(Use a 0.05 significance level for the test.)

	Pain Level Reported Using Cream	
Person	A	B
1	7	9
2	6	5
3	9	7
4	1	2
5	4	5

(8 points; 8 minutes)

2. **The popularity of TV shows is important to advertisers. A random sample of 1500 TV viewers in California was studied with the results shown below. Use these results to decide whether the popularity of the selected TV shows is the same in CA and NY or different.**
   (Use a Type I error rate of 0.01 to make your decision.)

Popularity of Selected TV Shows		
	Monday 6 p.m. Audience	
Show	**Share in NY**	**Viewers in CA sample**
Lost	**31%**	**426**
American Idol	**26%**	**414**
Boston Legal	**19%**	**333**
Friends	**24%**	**327**

(8 points; 8 minutes)

3. **The popularity of TV shows is important to advertisers. A random sample of 1600 TV viewers in California was studied with the results shown below. Use these results to decide whetherthe selected TV shows are equally popular.**
   (Use a Type I error rate of 0.01 to make your decision.)

Popularity of Selected TV Shows Monday 6 p.m. Audience	
Show	**CA sample**
Lost	**416**
American Idol	**414**
Boston Legal	**383**
Friends	**387**

(8 points; 12 minutes)

4. **Random samples of 500 women and 500 men were asked to evaluate their job satisfaction as "Excellent," "High," "Moderate," or "Low." Use the data below to test the claim that women and men have the same proportions of these ratings.** (Use α = 10% for this test.)

Job Satisfac	Gender		Row Total
	Female	Male	
Exceller	64	72	136
High	103	126	229
Moderat	201	178	379
Low	132	124	256
Col. Tot	500	500	1000

Claim: ______________________________

____

H_0: ______________________________

____

H_1: ______________________________

____

(8 points; 8 minutes)

1. **A study of different "rehabilitation" programs needed the participation of 500 inmates from California prisons. A randomized list of all prisoners was prepared and the first 250 names on the list were assigned to rehab method #1 and the rest were assigned to rehab method #2. The rates of recidivism (later conviction and return to prison for another crime) were studied. Use the results below to make a 90% confidence interval for the difference between the recidivism rates for the two methods.**

	Rehabilitation Method	
	Method 1	Method 2
Returned to Prison	112	175
Did not return to Prison	388	325

(3 points; 2 minutes)

11. Assign the three sample correlation coefficients to the three pictures. A correlation value may be used more than once or not at all. If a picture has no appropriate value offered for its correlation, select the "N/A" option.

r = ________ r = ________ r = ________

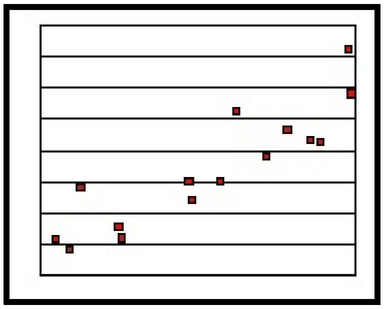
Values

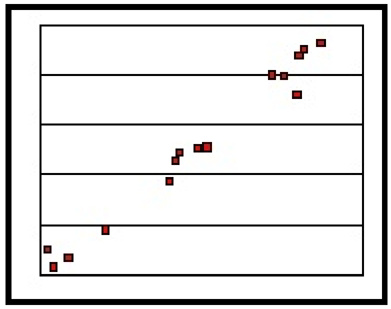
0.98

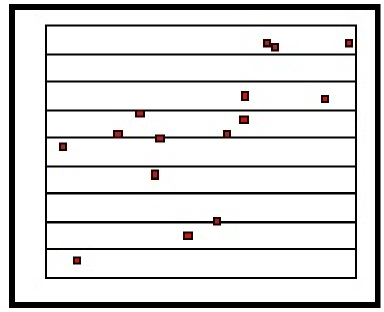
0.60

0.90

N/A







(3 points; 2 minutes)

12. Assign the three sample correlation coefficients to the three pictures. A correlation value may be used more than once or not at all. If a picture has no appropriate value offered for its correlation, select the "N/A" option.

r = ________ r = ________ r = ________

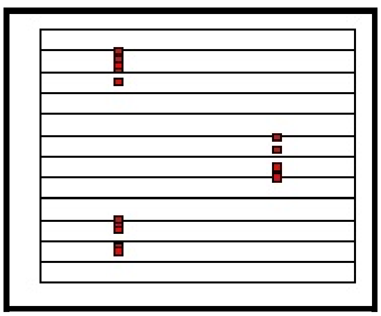
Values

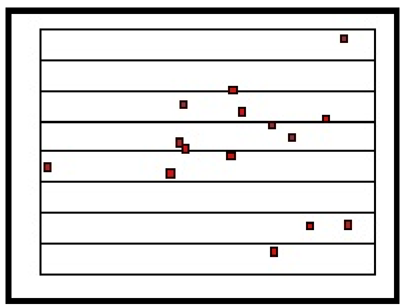
-0.80

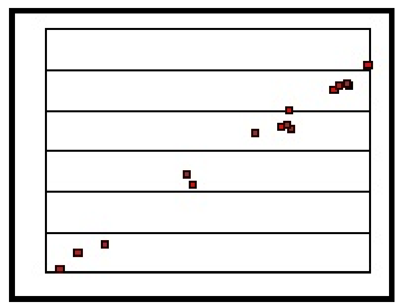
1.00

0.00

N/A







(3 points; 2 minutes)

13. Assign the three sample correlation coefficients to the three pictures. A correlation value may be used more than once or not at all. If a picture has no appropriate value offered for its correlation, select the "N/A" option.

r = ________ r = ________ r = ________

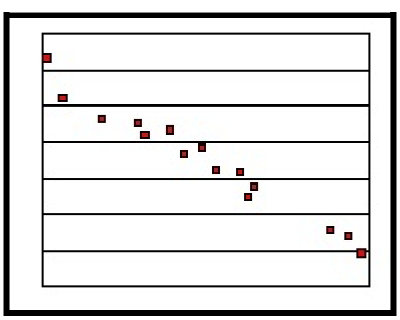
Values

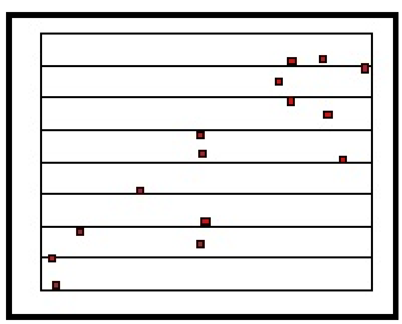
0.00

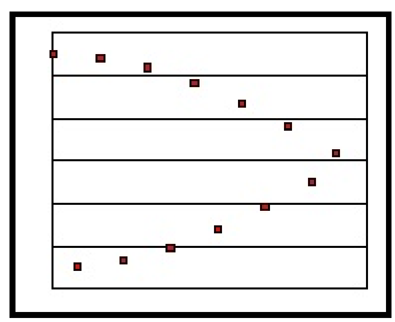
-0.70

0.85

N/A







(10 points : 10 minutes)

1. **Use the following information (data, etc.) to complete the Analysis of Variance table and test the appropriate hypothesis for "One Way" AOV. Use a 2% significance level for the test.**

Medicare costs for random samples of medicare patients in each state.

State:	AZ	CA	NV	OR	WA
	$2,348	$5,481	$4,051	$3,732	$5,522
	$3,895	$5,493	$2,085	$5,279	$4,352
	$2,569	$6,406	$4,291	$4,514	$4,399
	$4,063	$3,115	$2,162	$5,521	$6,161
	$5,261	$5,108	$3,383	$5,574	$4,587
	$3,572	$5,273	$4,861	$3,175	$5,370
	$2,668	$4,869	$4,809	$5,608	$3,306
	$4,079	$2,414	$3,361	$4,201	$4,341
	$2,932	$4,099	$3,360	$4,065	$4,261
	$3,478	$5,843	$4,563	$2,744	$4,313
	$2,505	$5,483		$2,883	$3,126
	$3,699	$3,510		$3,656	
	$2,730			$3,357	
Avg.	$3,369.15	$4,757.83	$3,692.60	$4,177.62	$4,521.64
St.Dev.	$819.87	$1,244.86	$1,058.09	$1,078.95	$877.17
n	13	12	10	13	11
d.f.	12	11	9	12	10

H_0: ______________________

____

H_1: ______________________

____

Selected Summary Statistics:

70566800 = total sum of squares

56852688 = sum of squares for error

Anova Table

Source	SS	d.f.	MS	F	p-value
States					0.0183
Error					
Total					

(10 points - 15 minutes)

5. **The following data are "random" measurements of responses to eight different "treatments". An incomplete Analysis of Variance table is given. Use the data to complete the ANOVA table (but do not include a p-value). Then use the results in your your table to carry out the appropriate test of the claim that the true means of the eight populations are all equal.**
(Use α = 0.025 for this test)

	Treatment							
	A	B	C	D	E	F	G	H
	107	100	108	104	101	96	111	110
	104	98	95	101	100	97	104	117
	97	93	102	109	101	103	112	115
	100	95	99	98	106	99	110	109
	105		98	97	95	100	119	
	102		96	89		105		
	101		96	103		108		
	96					97		
	Sample Statistics for each Treatment							
Mean	101.5	96.5	99.1	100.1	100.6	100.6	111.2	112.8
Std. Dev.	3.82	3.11	4.56	6.34	3.91	4.31	5.36	3.86
N	8	4	7	7	5	8	5	4

Overall Mean =	**102.25**

H1: ____________________

H0: ____________________

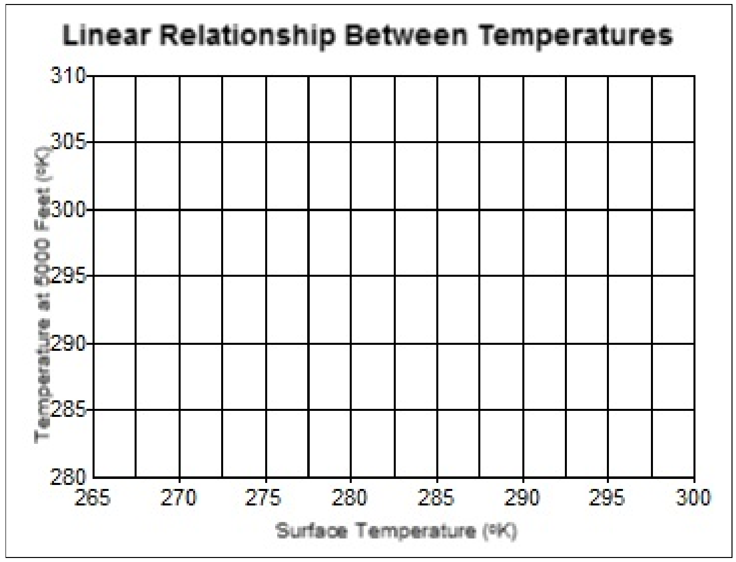
Analysis of Variance

Source	df	SS	MS	F
Treatments			158.81	
Error				
Total		1959.0		

(6 points; 7 minutes)

2. Based on the data given below, do parts (a) through (d).

Observation	Temperature (°K) at 5000 feet	Surface
1	296	304
2	277	294
3	275	287
4	288	304
5	276	286
6	267	287
	(Y)	(X)



(a) Plot the data points on the graph.

(b) Enter data in calculator and write the equation for the best-fitting line: ____________________

(c) Plot the line on the graph.

(d) Predict the temperature at 5000 feet when the surface temperature is 280 °K?. ____________

(e) What is the proportion of the variability in Y that is "explained" by the temperature at the surface? ____________

(b) The expression for the total variability in Y is: ____________

(c) The value of the total variability in Y is: ____________

(d) The expression for the explained variability in Y is: ____________

(e) The value of the explained variability in Y is: ____________

(f) The expression for the unexplained variability in Y is: ____________

(g) The value of the unexplained variability in Y is: ____________

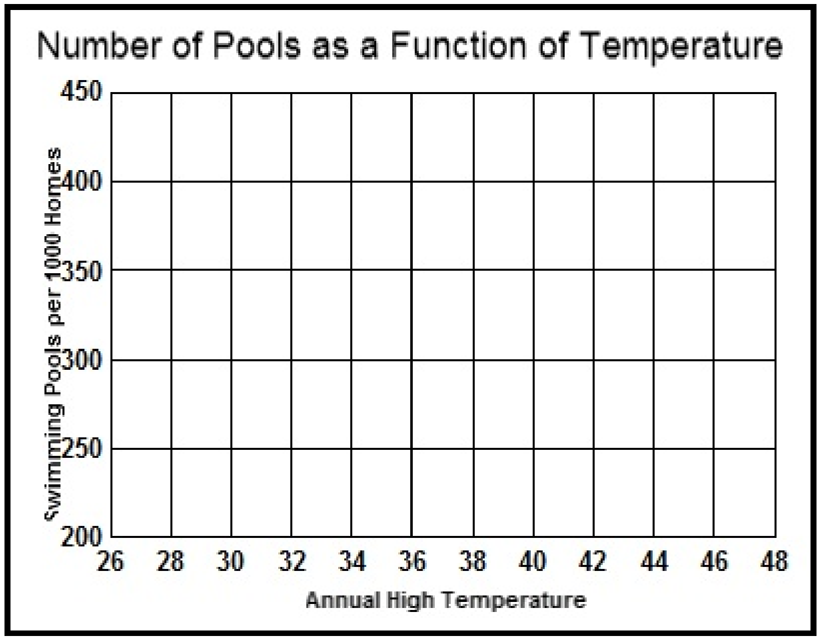
(h) The expression for the Standard Error of Estimate is: ____________

(i) The value of the Standard Error of Estimate is: ____________

(15 points : 15 minutes)

2. Use the data below to answer the questions on this page.

Community	Swimming Pools Per 1000 Homes	Annual High Temp. (°C)
1	380	45
2	430	45
3	199	29
4	331	36
5	224	33
6	260	30



(a) Plot the points on the graph.

(b) Determine the equation of the line that fits the data best and plot it:

intercept = ____________ **slope =** __________ **equation:** ______________________________

(c) For a new community, what is the estimated number of swimming pools per 1000 homes if the annual high temperature is 45 °C? ________________

(d) What is the value of the linear correlation coefficient for the two variables? ______________

(e) What percentage of the total variation in number of pools is explained by your line? ______________

(f) Write the symbolic expressions and give the values for the three items below:

	Total variation in number of pools	Explained variation in number of pools	Unexplained variation in number of pools
Symbolic expression	____________________	________________	________________
value	____________________	________________	________________

(g) Write the symbolic expression and give the value for the standard error of estimate:

Symbolic expression ____________________ ________________