LSI
Learning Styles Inventory

Our group number is _____.

Each group will analyze data for different classifications of people. Our group will use

Gender	Level	Race
G Female	G Primary (K-5)	G White
G Male	G Secondary (6-12)	G Other
	G Post Secondary	

The members of our group are

    1.   _____

    2.   _____

    3.   _____

Be sure that you have logged into the computer as "math" with a password of "richland".

Variable Key

CE	Concrete Experience	Feeling
RO	Remote Observation	Watching
AC	Abstract Conceptualization	Thinking
AE	Active Experimentation	Doing
AC-CE	Abstract-Concrete	
AE-RO	Active-Reflective	
Style	Learning Style (Diverger, Assimilator, Converger, Accomodator)	
Sex	Gender (Female, Male)	
Level	Teaching Level	
	-- Primary (K-5), Secondary (6-12), Post Secondary (13+)	
Race	Race (White, Other)	
State	State or Province	
Age	Age of person	
Years	Years person has been teaching	

Getting Started - Do this the first time only
In the r:\pub folder, you will find a worksheet called LSI. Open that worksheet.
Save your project into the R:\lsi folder as "groupX" where the X is your group number.

Continuing - Do this after the first time

Open your project from where you saved it.

Use MINITAB to perform the statistical analysis on the LSI data.

Each group should collectively turn in one project. There are no individual parts to this project. Your final project should be submitted as a double spaced Microsoft Word file. You can copy and paste from Minitab into Word to include output and charts. Save your Word file in the R:\LSI directory.

Complete each of the following tasks: (45 points)

Any time that you have a hypothesis test where the decision is to reject the null hypothesis, indicate it with a * or ** after the p-value. Add a footer to the table that indicates the results are significant at the $\alpha=0.05$ or $\alpha=0.01$ level. See #5 for an example.

Fully explain what we're looking at in the Word document. Either say things like "there are no significant differences" or "Males tend to score higher on abstract conceptualization (AC) scale than females." Be sure to explain any tests where you've rejected the null hypothesis.

For questions 1-3, subset your worksheet so that only those satisfying all of your categories are selected. Go to Manip / Subset worksheet. Name your worksheet as "cohort" and click on condition. Your condition should be something like this (use the values for your group):

    sex="female" and level="primary" and race="white"

Note that Minitab is case sensitive when you put things in quotes. Variable names don't need quotes unless the contain special characters like spaces or quotes. The easiest way to get the variable name is probably to double-click the name from the left side.

1.   Fully describe your group's data.

        Give the summary statistics for the four test scores (CE, RO, AC, AE), the combined AC-CE and AE-RO scores, the age, and years of teaching.

        Highlight the output, copy it, switch to Word, and paste it into your project.

Here are the summary statistics for white females at the primary level (K-5) of teaching.

White Primary Level (K-5) Female Teachers			
Variable	n	mean	st. dev.
Feeling (CE)	250	27.136	7.214
Watching (RO)	250	30.736	7.926
⋮	⋮	⋮	⋮
Years Teaching	249	14.892	9.184

2. Determine if your group's data is normally distributed.

    Go to Stat / Basic Statistics / Normality Test and test each of the scalar variables (CE, RO, AC, AE, AC-CE, AE-RO, Age, and Years).

    Create a table in Word with columns for the variable, test statistic (A-squared), p-value, and Normality (Yes / No). Use one row for each variable. Here is a sample table (you obviously need to use your data and supply the additional rows).

    You do not need to copy any of the normal probability plots and may close them after recording the test statistic and p-value

Most of the tests require that the data come from a population that is essentially normally distributed. The Anderson-Darling test for normality was performed on each of the variables to test for normality for the white, female teachers at the primary level.

H$_0$: The sample comes from a population that is normally distributed
H$_1$: The sample comes from a population that is not normally distributed

White Primary Females: Normality Tests			
Variable	A-Squared	P-value	Normal?
Feeling (CE)	0.627	0.098	Yes
Watching (RO)	0.510	0.189	Yes
⋮	⋮	⋮	⋮
Years Teaching	0.317	0.531	Yes

As shown in the table, each of the samples appears to come from a normal population.

3. Make a scatter plot of your group's data. Try to make it look like "The Learning-Style Type Grid" (the negative directions are up and right) so you may need to Calculate new variables CE-AC for the Y and RO-AE for the X instead of AC-CE and AE-RO. However, the labels should still be "AC-CE" and "AE-RO".

    These instructions will probably change and the instructor may make available a macro to do much of the work for you. You may want to look online for additional instructions on how to do this. For now, I'm leaving it intentionally vague so that I can get the instructions into your hands.

    Copy the graph into Word.

For question 4, switch back to the original worksheet that had all of the data. Now subset it so that just your teaching level is selected. Use an appropriate worksheet name (like "secondary") and set the condition (like level = "secondary"). Remember to periodically save your project and your Word document.

4. For those people in your teaching level category, test the variables CE, RO, AC, AE, AC-CE, AE-RO, Age, and Years to see if there is a difference in the scores between the sexes.

    Go to Stats / Basic Statistics / 2-Sample t. Use the variable you're testing for the samples and "sex" for the subscripts.

    Create a table in Word that contains the results of each of the tests. Here is a sample table. Of course, you'll need to finish the table with the other variables.

Is there a difference between the genders at the secondary level of teaching? A two sample t test was used to conduct the hypothesis test that the mean of males was equal to the mean of females

$$H_0 : \mu_m = \mu_f$$
$$H_1 : \mu_m \neq \mu_f$$

Secondary (6-12) Teachers: Comparison by Gender				
Variable	Male	Female	Difference	p-value
Feeling (CE)	24.77	26.34	-1.563	0.074
Watching (RO)	29.56	29.13	0.433	0.613
⋮	⋮	⋮	⋮	⋮
Years Teaching	15.80	13.88	1.900	0.125

As you can see from the table, there were no significant differences in any of the variables. There is nothing to suggest that there are any gender differences within the secondary level of teaching.

For question 5, switch back to the document that contains all of the data. Now subset it so that you have just the data for your gender. Name the worksheet appropriately (like "male") and set the condition (sex="male").

5. For the gender of your group, test the claim that there is no difference between the mean scores for the variables CE, RO, AC, AE, AC-CE, AE-RO, Age, and Years for the different races.

    Go to Stats / Basic Statistics / 2-Sample t. Use the variable you're testing for the samples and "race" for the subscripts. Repeat for each variable.

    Create a table in Word to summarize the results. Make comments explaining the results.

Does race affect the scores of males? A two sample t-test was conducted to test the hypothesis that the mean of white males was equal to the mean of other males.

$$H_0 : \mu_w = \mu_o$$
$$H_1 : \mu_w \neq \mu_o$$

Male Teachers: Comparison by Race				
Variable	Other	White	Difference	p-value
Feeling (CE)	23.65	24.16	-0.51	0.638
Watching (RO)	31.22	29.06	2.15	0.090
⋮	⋮	⋮	⋮	⋮
Doing (AE)	31.65	34.30	-2.66	0.020*
⋮	⋮	⋮	⋮	⋮
Years Teaching	11.74	16.00	-4.26	0.011*

* Significant at the $\alpha=0.05$ level.

Race appears to be a factor for Doing (AE), Active-Reflective (AE-RO), Age, and Years Teaching.

White male teachers are more likely to prefer Doing and being Active than other races. White teachers have been are older and have taught more years than other races.

For question 6, switch to the worksheet that contains just the data for your level of teaching that you used to answer question 4. If you have closed out that worksheet, then go through the instructions for question 4 again.

6. For your level of teaching, is the gender related to the learning style (accomodator, diverger, converger, assimilator)?

    Go to Stats / Tables / Cross Tabulation. Use the classification variables of sex and style. Turn on the display of the Row Percents. Check the Chi-Square Analysis box.

    Create a table in Word that shows results.

Among secondary teachers, are gender and learning style related? A contingency table was created and a chi-square test conducted to test the hypothesis.

H_0: gender and learning style are independent
H_1: gender and learning style are related

Secondary (6-12) Teachers: Learning Styles by Gender				
Percent	Diverger	Assimilator	Converger	Accomodator
Female n =463	16.85%	30.67%	23.11%	29.97%
Male n = 220	11.82%	36.36%	30.91%	20.91%
Total n = 683	15.23%	32.50%	25.62%	26.65%

Percents shown in the table are the row percentages. That is 16.85% of females are Divergers.

The p-value for the contingency table was p-value=0.009, so the results are unusual at the $\alpha=0.01$ level of significance. There is sufficient evidence to support the claim that the gender and learning styles of secondary teachers are related.

For questions 7 and 8, choose the worksheet that contains the cohort used for questions 1-3. If you have already closed this file, then follow the instructions for questions 1-3 to recreate the cohort.

7. Within your cohort, are there differences in the ages and years teaching for the different learning styles?

   Go to Stat / ANOVA / One-Way. Your response variable is Age and the Factor is Style. Repeat with Years as the response variable.

   Create a table in Word that summarizes the data and describe the results. Create one table for age and another table for years teaching.

Is learning style related to age and years teaching? Data for the white, female, primary teachers was examined and the means of the age and years for each of the different learning styles was compared. A One-way ANOVA was conducted to test the hypothesis.

H_0: The mean age of the different learning styles are all the same.
H_1: The mean age of at least one learning style is different.

White Primary Females: Mean Age by Learning Styles			
	n	mean	st. dev
Diverger	66	43.939	9.240
Assimilator	64	42.156	9.873
Converger	31	39.839	9.529
Accomodator	88	42.045	10.018

The p-value from the ANOVA was p-value=0.271 which is not significant, so there is no evidence to suggest a difference in the mean age of the different learning styles.

8.   Is there correlation between the different variables for your cohort?

Go to Stat / Basic Statistics / Correlation. Choose CE, RO, AC, AE, AC-CE, and AE-RO for the variables.

Create a table in Word that summarizes the results. Indicate significant correlations with * (α=0.05) or ** (α=0.01).

Is there any linear correlation between the scores on the exams for the white females who teach at the primary level (K-5)? Linear Correlation coefficients and the corresponding p-values were computed to test the hypothesis for pair of variables.

H_0: $\rho = 0$
H_1: $\rho \neq 0$

White Primary Females: Correlation between Variables					
	CE	RO	AC	AE	AC-CE
RO	-0.503**				
AC	-0.421**	-0.088			
AE	-0.051	-0.512**	-0.415**		
AC-CE	-0.854**	0.257**	0.832**	-0.207	
AE-RO	0.275**	-0.882**	-0.174**	0.856**	-0.268**

** Significant at the $\alpha=0.01$ level.

When you have completed all of the documentation, print out the Word file and give it to the instructor.

Evaluation (5 points)

Each student should do the following. This portion is not a group effort, it is an individual activity. It must be typed and printed, no handwritten papers.

! Put your name and section at the top of the paper
! For each person in your group (including yourself), give their name and assign them a score between 0 (lowest) and 5 (highest) for their effort in making this project a success. Then write a short paragraph about what each person contributed and why they deserve the grade you're giving them.

Example Evaluation:

Steve Jackson – 5
I am a hard worker who really knew how to use the computer to do Minitab and Word. I wasn't very good at understanding the statistical side of things but I was a good organizer and kept us on task. I was always there and stayed late a few times.

Bob Smith – 1
Bob is a bum! I don't know why I ever picked him to be in my group. I should have known better than to pick the person who sat next to me as a partner. Bob missed half of the class periods we spent working on this project. When we did work together in class, he was playing on his cell phone instead of helping with the project. The only reason he gets 1 point is because he knew that a p-value < 0.05 meant to reject the null hypothesis.