

Module 5 Task

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PART 1

** Public Perception Dataset

The Public Perception dataset includes data from 1,034 telephone interviews among residents of Orange County, Florida. The survey instrument has seven sections encompassing 96 separate items. The first section asks the importance of various issues to residents, from controlling government spending to building a light rail transportation system. The rationale for asking these questions is that their ranking may inform county officials in their strategic planning and allocation decisions.

Use the public perception dataset. You will use the selected variables as below.

How important are the following issues for you? Please state whether you consider each issue Very Important (=3), Important (=2), Somewhat Important (=1), or Unimportant (=0).

Very Important (=3) Important (=2) Somewhat Important (=1) Unimportant (=0).

Helping public schools (PUBSCHL)	[]	[]	[]	[]
Providing youth improvement programs (YOUTH)	[]	[]	[]	[]

How satisfied are you with the following services in Orange County? Who you say you are very satisfied, satisfied, dissatisfied, or very dissatisfied?

Very Satisfied (=1) Satisfied (=2) Don't know (=3) Dissatisfied (=4) Very Dissatisfied (=5)

Schools (SCHLSAT)	[]	[]	[]	[]	[]
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** Demographics*

GENDER: What is your gender (Male = 1; Female =2)

KIDS: Do you have children under 18 years old living at home with you? (1=Yes, 2=No)

**NOTE: Be careful of your interpretation. For SCHLSAT, 1 means very satisfied. For PUBSCHL and YOUTH, 3 means very important.*

1. Factors affecting residents' levels of satisfaction with public schools.

(1-a) The NIU MPA Research Team wants to compare how satisfied women and men are with public schools. Using the t-test analysis, Team needs to analyze if there is a significant difference in level of satisfaction with schools between males and females.

- **What is hypothesis?**

- **Null hypothesis (H_0) and Alternative hypothesis (H_a):**

Null Hypothesis (H_0): There is no significant difference in the level of satisfaction with public schools between males and females.

Alternative Hypothesis (H_a): There is a significant difference in the level of satisfaction with public schools between males and females.

- **In your Excel file,** provide step-by-step procedures, including
 - Descriptive statistics
 - F-test two sample for variance
 - Two-sample assuming equal (or unequal) variances

Answer

Step-by-Step Procedures for Calculating T-test

Step 0: Organize Data

- Prepare your data into two groups based on the categories of interest (e.g., Male vs. Female, Kids vs. Without Kids).
- Organize the data into separate columns, with one group in Column A and the other group in Column B.

Step 1: Calculate Descriptive Statistics

- Go to the Data tab, then click on Data Analysis.
- Select Descriptive Statistics and choose the data range for each group (Column A and Column B).
- Ensure that the "Summary statistics" option is checked.
- Click OK to generate the descriptive statistics for each group.

Step 2: Test for Variance (F-Test for Equal Variance (H_0 = Equal Variance))

- Take note of the variance of each of the two groups. The group with the larger variance should be used as Column A (First Group) and the other for Column B (Second Group).
- Navigate to the Data Analysis tab and choose F-test Two Sample for Variances.
- Select the data range for each group (Column A and Column B).
- Click OK to perform the F-test for variances and determine whether the variances are equal or unequal.
- If P is less than 0.05, reject the null hypothesis and calculate the t-test assuming unequal variance. If P exceeds 0.05, we cannot reject the null hypothesis and calculate the t-test assuming equal variance.

Step 3: Perform T-Test Assuming Equal/Unequal Variance

- Once you have determined the variance assumption, go to the Data Analysis tab again.
- Select T-test: Two Samples Assuming Equal Variance or Unequal Variance.

- Choose the data range for each group (Column A and Column B).
- Click OK to calculate the t-statistic assuming equal (or unequal) variances between the two groups.

I used the steps above to calculate the t-test statistic starting from the descriptive analysis.

Step 1: Descriptive Statistics

<i>SCHLSAT – MALE</i>		<i>SCHLSAT - FEMALE</i>	
Mean	3.035555556	Mean	3.04878
Standard Error	0.052051747	Standard Error	0.046743
Median	3	Median	3
Mode	2	Mode	2
Standard Deviation	1.104184298	Standard Deviation	1.119893
Sample Variance	1.219222965	Sample Variance	1.254161
Kurtosis	-1.10093308	Kurtosis	-1.11494
Skewness	0.138900185	Skewness	0.143103
Range	4	Range	4
Minimum	1	Minimum	1
Maximum	5	Maximum	5
Sum	1366	Sum	1750
Count	450	Count	574

Step 2: F-Test for Equal Variance ($H_0 = \text{Equal Variance}$)

F-Test Two-Sample for Variances

	<i>SCHLSAT - FEMALE</i>	<i>SCHLSAT - MALE</i>
Mean	3.048780488	3.035555556
Variance	1.254160814	1.219222965
Observations	574	450
Df	573	449
F	1.028655833	
P(F<=f) one-tail	0.377130489	
F Critical one-tail	1.158943309	

Because $P=0.377 > 0.05 \rightarrow$ we cannot reject the null hypothesis \rightarrow Therefore, variances are equal.

Given that the probability associated with the F-statistic is greater than the commonly used significance level of 0.05, we do not have sufficient evidence to reject the null hypothesis. Therefore, we fail to reject the hypothesis that the variances of the two groups being compared are equal. This implies that for the t-test we will assume an equal variance stance for the calculation.

Step 3: T-test with Equal Variances

t-Test: Two-Sample Assuming Equal Variances

	<i>SCHLSAT - MALE</i>	<i>SCHLSAT - FEMALE</i>
Mean	3.035555556	3.048780488
Variance	1.219222965	1.254160814
Observations	450	574
Pooled Variance	1.238811407	
Hypothesized Mean Difference	0	
df	1022	
t Stat	-0.188713549	
P(T<=t) one-tail	0.425177399	
t Critical one-tail	1.646345955	
P(T<=t) two-tail	0.850354798	
t Critical two-tail	1.962287894	

Interpretation:

Critical Value: Because the calculated t-statistic (-0.189) is much smaller than the critical value (1.962), we fail to reject the null hypothesis.

P-Value: Given that the p-value (0.850) is much greater than the significance level of 0.05, we fail to reject the null hypothesis.

Report the hypothesis test results. What is your conclusion?

In summary, based on the analysis using both the critical value and the p-value, we conclude that there is no statistically significant difference in the level of satisfaction with public schools between males and females. Therefore, we do not have sufficient evidence to reject the null hypothesis, which suggests that the means of satisfaction levels for males and females are not significantly different.

(1-b) The NIU MPA Research Team wants to know whether residents living with kids and residents without kids have different levels of satisfaction with public schools. Using the t-test analysis, Team needs to analyze if there is a significant difference in level of satisfaction with schools between them.

• **What is hypothesis?**

- **Null hypothesis (H_0) and Alternative hypothesis (H_a):**

Null Hypothesis (H_0): There is no significant difference in the level of satisfaction with public schools between residents living with kids and residents without kids.

Alternative Hypothesis (H_a): There is a significant difference in the level of satisfaction with public schools between residents living with kids and residents without kids.

- **In your Excel file, provide step-by-step procedures, including**
 - Descriptive statistics
 - F-test two sample for variance
 - Two-sample assuming equal (or unequal) variances

Step 1: Descriptive Statistics

SCHLSAT - WITH KIDS		SCHLSAT - WITHOUT KIDS	
Mean	3.034031414	Mean	3.050314465
Standard Error	0.062830804	Standard Error	0.041225889
Median	3	Median	3
Mode	2	Mode	2
Standard Deviation	1.228016765	Standard Deviation	1.039677371
Sample Variance	1.508025175	Sample Variance	1.080929035
Kurtosis	-1.309979033	Kurtosis	-
Skewness	0.097348085	Skewness	0.185994778
Range	4	Range	4
Minimum	1	Minimum	1
Maximum	5	Maximum	5
Sum	1159	Sum	1940
Count	382	Count	636

Step 2: F-Test for Variance for Equal Variance (H_0 = Equal Variance)

F-Test Two-Sample for Variances

	<i>SCHLSAT - WITH KIDS</i>	<i>SCHLSAT - WITHOUT KIDS</i>
Mean	3.034031414	3.050314465
Variance	1.508025175	1.080929035
Observations	382	636
Df	381	635
F	1.3951195	
P(F<=f) one-tail	0.000115715	
F Critical one-tail	1.160965989	

$P=0.00 < 0.05 \rightarrow$ We reject the null hypothesis – Therefore variances are unequal.

Step 3: T-test with Unequal Variance

t-Test: Two-Sample Assuming Unequal Variances

	<i>SCHLSAT - WITH KIDS</i>	<i>SCHLSAT - WITHOUT KIDS</i>
Mean	3.034031414	3.050314465
Variance	1.508025175	1.080929035
Observations	382	636
Hypothesized Mean Difference	0	
Df	702	
t Stat	-0.216678588	
P(T<=t) one-tail	0.414260894	
t Critical one-tail	1.647027123	
P(T<=t) two-tail	0.828521788	
t Critical two-tail	1.963349023	

Critical Value: The t-statistic (-0.217) is smaller in magnitude than the critical value (1.963). Hence, we cannot reject the null hypothesis.

P-Value: $0.828 > 0.05$. The p-value is greater than the significance level of 0.05. We fail to reject the null hypothesis.

- **Report the hypothesis test results. What is your conclusion?**

The t-test analysis conducted on the data aimed to compare the mean satisfaction levels of these two groups (residents with kids vs. residents without kids). Since the p-value (0.829) is greater than the significance level of 0.05, and the t-statistic (-0.217) does not exceed the critical value (1.963), we fail to reject the null hypothesis. Therefore, based on the analysis, we conclude that there is no statistically significant difference in the level of satisfaction with public schools between residents living with kids and residents without kids.

2. Factors affecting residents' perception of the importance of education.

First of all, the NIU MPA Research Team wanted to create a new variable of 'importance of education' by averaging the importance of helping public schools (PUBSCHL) and the importance of providing youth improvement programs (YOUTH).

***Tip:** you can create a new column using the formula =AVERAGE(E2,F2). Delete all errors.

Answer:

The new variable was created on the Excel sheet as "Importance of Education" just like the assignment stated. I also used the formula =AVERAGE(E2,F2) to get the average and also deleted all errors just like the assignment stated.

This new variable was used to solve Questions 2a and Questions 2b.

(2-a) The NIU MPA Research Team wants to know whether male and female residents have different perceptions of the importance of education issues. Using the t-test analysis, Team needs to analyze if there is a significant difference in perceived importance of education issues between males and females.

- **What is hypothesis?**
 - **Null hypothesis (H_0) and Alternative hypothesis (H_a):**

Null Hypothesis (H_0): There is no significant difference in the perceived importance of education issues between male and female residents.

Alternative Hypothesis (H_a): There is a significant difference in the perceived importance of education issues between male and female residents.

- **In your Excel file, provide step-by-step procedures, including**
 - Descriptive statistics
 - F-test two sample for variance
 - Two-sample assuming equal (or unequal) variances

Step 1: Descriptive Statistics

IMPORTANCE OF EDUCATION - MALE		IMPORTANCE OF EDUCATION - FEMALE	
Mean	2.305309735	Mean	2.538062284
Standard Error	0.033433626	Standard Error	0.027387941
Median	2.5	Median	3
Mode	3	Mode	3
Standard Deviation	0.710808628	Standard Deviation	0.658450771
Sample Variance	0.505248906	Sample Variance	0.433557417
Kurtosis	0.9051997	Kurtosis	2.782122417
Skewness	1.057800238	Skewness	1.680459772
Range	3	Range	3
Minimum	0	Minimum	0
Maximum	3	Maximum	3
Sum	1042	Sum	1467
Count	452	Count	578

Step 2: F-Test for Variance for Equal Variance (H_0 = Equal Variance)

F-Test Two-Sample for Variances

	IMPORTANCE OF EDUCATION - MALE	IMPORTANCE OF EDUCATION - FEMALE
Mean	2.305309735	2.538062284
Variance	0.505248906	0.433557417
Observations	452	578
df	451	577
F	1.165356389	
P(F<=f) one-tail	0.041908961	
F Critical one-tail	1.156714272	

Because $P = 0.0419 < 0.05$ -> we reject the null hypothesis -> Therefore, variances are unequal. The p-value of 0.0419 is less than the significance level of 0.05. Therefore, we have sufficient evidence to reject the null hypothesis. The statistically significant p-value suggests that unequal variances should be considered for the t-test.

Step 3: T-test with Unequal Variances

t-Test: Two-Sample Assuming Unequal Variances

	IMPORTANCE OF EDUCATION - MALE	IMPORTANCE OF EDUCATION - FEMALE
Mean	2.305309735	2.538062284
Variance	0.505248906	0.433557417
Observations	452	578
Hypothesized Mean Difference	0	
df	932	
t Stat	-5.385386309	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.646490209	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.962512592	

Critical Value:

Since the t-statistic (-5.385) is much larger than the critical value (1.963), we reject the null hypothesis. The critical value of approximately 1.96 represents the threshold beyond which we would reject the null hypothesis at a significance level of 0.05 in a two-tailed t-test.

P-Value:

In this case, the extremely low p-value of 0.00 suggests strong evidence against the null hypothesis. Since the p-value is effectively zero, it indicates that the probability of observing such an extreme t-value under the assumption of no difference between the groups is highly improbable. Therefore, we reject the null hypothesis and conclude that there is a statistically significant difference between the means of the two groups being compared.

Report the hypothesis test results. What is your conclusion?

Since the absolute value of the calculated t-statistic (-5.39) is greater than the critical value (1.96), and the p-value is essentially zero, we reject the null hypothesis. Therefore, we conclude that there is a significant difference in the perceived importance of education issues between male and female residents. Specifically, the evidence suggests that male and female residents hold differing perceptions regarding the importance of education issues.

Since the p-value is significantly lower than the commonly used significance level of 0.05, we reject the null hypothesis. Therefore, we conclude that there is a statistically significant difference in the perceived importance of education issues between male and female residents.

(2-b) The NIU MPA Research Team wants to know whether residents living with kids and residents without kids have different perceptions of the importance of education issues. Using the t-test analysis, Team needs to analyze if there is a significant difference in perceived importance of education issues between them.

- What is hypothesis?
 - Null hypothesis (H_0) and Alternative hypothesis (H_a):

Null Hypothesis (H_0): There is no significant difference in the perceived importance of education issues between residents living with kids and residents without kids.

Alternative Hypothesis (H_a): There is a significant difference in the perceived importance of education issues between residents living with kids and residents without kids.

- In your Excel file, provide step-by-step procedures, including
 - Descriptive statistics
 - F-test two sample for variance
 - Two-sample assuming equal (or unequal) variances

Step 1: Descriptive Statistics

IOE - WITH KIDS		IOE - WITHOUT KIDS	
Mean	2.536553525	Mean	2.379095
Standard Error	0.03438565	Standard Error	0.027306
Median	3	Median	2.5
Mode	3	Mode	3
Standard Deviation	0.672940431	Standard Deviation	0.69133
Sample Variance	0.452848824	Sample Variance	0.477937
Kurtosis	1.981131386	Kurtosis	1.541345
Skewness	-1.578014879	Skewness	-1.24663
Range	3	Range	3
Minimum	0	Minimum	0
Maximum	3	Maximum	3
Sum	971.5	Sum	1525
Count	383	Count	641

Step 2: F-Test for Variance for Equal Variance (H_0 = Equal Variance)

F-Test Two-Sample for Variances

	<i>IOE - WITHOUT KIDS</i>	<i>IOE - WITH KIDS</i>
Mean	2.379095164	2.536553525
Variance	0.477937305	0.452848824
Observations	641	383
Df	640	382
F	1.05540145	
P(F<=f) one-tail	0.280838473	
F Critical one-tail	1.164410276	

Because $P=0.28 > 0.05 \rightarrow$ we cannot reject the null hypothesis. Therefore, variances are equal.

This suggests that there is no statistically significant difference in variances between the two groups being compared. Hence, for the t-test, we will use the assumption of equal variances.

Step 3: T-test with Equal Variance

t-Test: Two-Sample Assuming

Equal Variances

	<i>IOE - WITH KIDS</i>	<i>IOE - WITHOUT KIDS</i>
Mean	2.536553525	2.379095164
Variance	0.452848824	0.477937305
Observations	383	641
Pooled Variance	0.46855981	
Hypothesized Mean Difference	0	
Df	1022	
t Stat	3.561735234	
P(T<=t) one-tail	0.000192697	
t Critical one-tail	1.646345955	
P(T<=t) two-tail	0.000385394	
t Critical two-tail	1.962287894	

Critical Value:

The t-statistic (3.562) is greater than the critical value (1.962), we reject the null hypothesis.

P-value:

The p-value is $0.00 < 0.05$, hence, we reject the null hypothesis.

Report the hypothesis test results. What is your conclusion?

Since the t-statistic (3.562) is much greater than the critical value (1.962), and the p-value is very low, we reject the null hypothesis. This indicates that the observed difference between the residents living with kids and residents without kids is statistically significant as regards the importance of education issues.

Additionally, the p-values associated with the two-tailed test (0.0003854) are extremely low, well below the commonly used significance level of 0.05. This further supports the conclusion that there is a significant difference in perceived importance between residents living with kids and residents without kids.

Therefore, based on this analysis, the NIU MPA Research Team can confidently conclude that residents living with kids and residents without kids hold different perceptions regarding the importance of education issues. Specifically, it indicates that the mean perception of importance among residents living with kids significantly differs from that among residents living without kids.

PART 2. Performance Report Project –Citizen Satisfaction Data

Using your variables in your research proposal, you need to complete all hypothesis testing for ttest analysis.

- 1) Develop t-test hypotheses (mean difference between two groups)
- 2) Run a t-test analysis
- 3) Report the result

Suggested table for the report:

Table # shows the t-test results.

Table #.

	Snow Removal on Major City Streets (Male)	Snow Removal on Major City Streets (Female)
Mean	4.145048815	4.123348018
Standard Deviation	0.804070409	0.823942073
Observations	681	717
T-test	t-stat= 0.498347026, p= 0.61831797	

Null Hypothesis (H0): There is no significant difference in the satisfaction levels of male and female residents regarding snow removal on major city streets.

Alternative Hypothesis (Ha): There is a significant difference in the satisfaction levels of male and female residents regarding snow removal on major city streets.

Step 1: Descriptive Statistics

<i>Snow_removal_on_major_City_streets - Male</i>		<i>Snow_removal_on_major_City_streets - Female</i>	
Mean	4.145048815	Mean	4.123348018
Standard Error	0.03002856	Standard Error	0.031573529
Median	4	Median	4
Mode	4	Mode	4
Standard Deviation	0.804070409	Standard Deviation	0.823942073
Sample Variance	0.646529222	Sample Variance	0.678880539
Kurtosis	2.139276135	Kurtosis	1.921205028
Skewness	-1.141295909	Skewness	-1.149924087
Range	4	Range	4

Minimum	1	Minimum	1
Maximum	5	Maximum	5
Sum	2972	Sum	2808
Count	717	Count	681

Step 2: F-Test for Variance for Equal Variance (H_0 = Equal Variance)

F-Test Two-Sample for Variances

	<i>Snow_removal_on_major_City_streets</i> – <i>Female</i>	<i>Snow_removal_on_major_City_streets</i> – <i>Male</i>
Mean	4.123348018	4.145048815
Variance	0.678880539	0.646529222
Observations	681	717
df	680	716
F	1.050038444	
P(F<=f) one-tail	0.259365413	
F Critical one-tail	1.132613226	

Because $P = 0.259 > 0.05$. We cannot reject the null hypothesis. Hence, variances are equal.

Step 3: T-test with Equal Variance

t-Test: Two-Sample Assuming Equal Variances

	<i>Snow_removal_on_major_City_streets</i> – <i>Male</i>	<i>Snow_removal_on_major_City_streets</i> – <i>Female</i>
Mean	4.145048815	4.123348018
Variance	0.646529222	0.678880539
Observations	717	681
Pooled Variance	0.662287743	
Hypothesized Mean Difference	0	
df	1396	
t Stat	0.498347026	
P(T<=t) one-tail	0.309158985	
t Critical one-tail	1.645945881	
P(T<=t) two-tail	0.61831797	
t Critical two-tail	1.961664768	

Critical Value: The t-statistic (0.498) is less than the critical value (1.962), we cannot reject the null hypothesis

P-Value: The p-value is greater than 0.05. Hence, we cannot reject the null hypothesis.

Since the p-value (0.618) is greater than the significance level of 0.05 and the t-statistic (0.498) is less than the critical value (1.962), we fail to reject the null hypothesis. This suggests that there is no statistically significant difference in the satisfaction levels of male and female residents regarding snow removal on major city streets.