Minitab Directions – 02

Statistical Inference on 2 Samples

Note: If you have *paired* data (e.g. before and after data), use the procedure in section 2.

1. 2-sample t test

Note: In class we said that when both samples have 30 or more values, then we use the 2sample *z* test; otherwise, use the 2-sample *t* test. Minitab only defines the 2-sample *t* test. So, you will use that when you have large samples.

1.1. Choose: Stats/Basic Statistics/2-sample t

Suppose that you want to test the alternate hypothesis that women study longer than men:

 $H_o \mu_{Women} - \mu_{Men} \le 0$ vs. $H_a \mu_{Women} - \mu_{Men} > 0$

Note the order the data is entered in the columns in the Minitab worksheet: Men, then Women. When you specify the data sets in the dialog below, you should put them in the order that you have specified them in your hypothesis. For the example above, we list "Women" for *First* and "Men" for *Second*.

2-Sample t (Test ar	nd Confidence Interval)	×
C1 Men C2 Women C3 Z-Men C4 Z-Women	Samples in one column Samples: Subscripts: Subscripts: Samples in different columns Eirst: Women Second: Men Sample size: Mean: Eirst: Sample size: Second: Sample size: Second: Sample size: Second: Sample size:	andard:
Select Help	Assume equal variances Graphs O QK	gtions Cancel

1.2. Select *Samples in different columns* and specify the two data sets. **If** (see below) you can assume equal variances, then check the appropriate box.

Note: A rule-of-thumb, for our class, is to assume equal variances if the standard deviation for one data set is at least twice as large as for the other. Otherwise, we will not assume equal variances.

1.3. Choose: *Options...* Specify the *Confidence level*, *Test difference* and *Alternative*.

Note: The *Test difference* and *Alternative* correspond with the hypothesis in step 1.1.

2-Sample t - Options	
Confidence level: 95.0	
Test difference: 0	
Alternative: greater than 💌	
Help <u>O</u> K Cancel	

1.4. Choose *OK*, then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

Two-sa	mple	T for	Women v	vs Men					
	N	Mean	StDev	SE M	ean				
Women	40	45.42	7.68		1.2				
Men	40	39.15	9.21		1.5				
Differ	ence	= mu	(Women)	- mu	(Me	n)			
<mark>Estima</mark>	te f	or diff	ference:	6.2	7				
95% 10 [.]	wer 1	bound f	for diff	erenc	e:	3.11			
<mark>T-T</mark> est	of	differe	ence = 0) (vs	<mark>>)</mark> :	T-Value =	= 3.30	P-Value = 0.001	DF = 78
Both u	se P	ooled S	StDev =	8.479	5				

Note: We get a one-sided confidence interval because we specified a one-sided alternative (>).

1.5. Generate a (two-sided) confidence interval, if necessary. Choose: *Stats/Basic Statistics/2-sample t* and then *Options...*. There, choose the "not equal" *Alternative*.

2-Sample t - Options 🛛 🔀
Confidence level: 95.0
Test difference: 0
Alternative: not equal
Help <u>OK</u> Cancel

1.6. Choose *OK*, then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

Two-sample T for W	Iomen vs Men						
N Mean	StDev SE Mean						
Women 40 45.42	7.68 1.2						
Men 40 39.15	9.21 1.5						
Difference = mu (W	Iomen) - mu (Men)						
Estimate for diffe	erence: 6.27						
95% CI for differe	ence: (2.49, 10.04)						
T-Test of differen	nce = 0 (vs not =):	T-Value = 3.30	P-Value = 0.001	DF = 78			
Both use Pooled StDev = 8.4795							

1.7. Copy the confidence interval only into your report immediately below the one-sided confidence interval.

This is the end of 2-sample statistical inference.

2. Paired t Test

Note: Use this procedure if you have *paired* data (e.g. before and after data).

2.1. Choose: Stats/Basic Statistics/Paired t

Suppose that you want to test the alternate hypothesis that women study longer than men:

 $H_o \mu_{Women} - \mu_{Men} \le 0$ vs. $H_a \mu_{Women} - \mu_{Men} > 0$

Note the order the data is entered in the columns in the Minitab worksheet: Men, then Women. When you specify the data sets in the dialog below, you should put them in the order that you have specified them in your hypothesis. For the example above, we list "Women" for *First* and "Men" for *Second*.

Paired t (Test and Confidence Interval)							
C1 Men C2 Women C3 Z-Men C4 Z-Women	Samples in <u>c</u> olumns Eirst sample: Women Second sample: Men Summarized data (differences)						
	Sample size: Mean: Standard deviation: Paired t evaluates the first sample						
Select	Graphs Options						
Help	<u>OK</u> Cancel						

2.2. Select *Samples in columns* and specify the two data sets.

2.3. Choose: *Options...* Specify the *Confidence level*, *Test difference* and *Alternative*.

Paired t - Options	<
Confidence level: 95.0	
Test mean: 0.0	
Alternative: greater than	
HelpOKCancel	

2.4. Choose *OK*, then choose *OK* again and the inference results will be displayed.

Paired T-Test and CI: Women, Men

Paired T for Women - Men							
	N	Mean	StDev	SE Mean			
Women	40	45.42	7.68	1.21			
Men	40	39.15	9.21	1.46			
Difference	40	<mark>6.265</mark>	3.578	0.566			
<mark>95% lower b</mark>	ound	for me	an diff	erence: 5	<mark>. 312</mark>		
T-Test of m	ean	differe	nce = 0	(vs > 0)	: T-Value = 11.08	P-Value = 0.000	

Note: We get a one-sided confidence interval because we specified a one-sided alternative (>).

2.5. Generate a (two-sided) confidence interval, if necessary. Choose: *Stats/Basic Statistics/2-sample t* and then *Options...*. There, choose the "not equal" *Alternative*.

2-Sample t - Options	×
Confidence level: 95.0	
Test difference: 0	
Alternative: not equal	
Help <u>OK</u> Cancel	1
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2.6. Choose *OK*, then choose *OK* again and the inference results will be displayed.

Two-Sample T-Test and CI: Women, Men

Two-sample T for	Women vs Men			
N Mean	StDev SE Mean			
Women 40 45.42	7.68 1.2			
Men 40 39.15	9.21 1.5			
Difference = mu	(Women) - mu (Men)			
Estimate for diff	ference: 6.27			
95% CI for differ	rence: (2.49, 10.04)			
T-Test of differe	ence = 0 (vs not =):	T-Value = 3.30	P-Value = 0.001	DF = 78
Both use Pooled S	StDev = 8.4795			

2.7. Copy the confidence interval only into your report immediately below the one-sided confidence interval

This is the end of 2-sample statistical inference.