Hypothesis testing
RMPP
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Interpretation of the results, based on the questions asked and from my analysis of the data.

Exercise 8.4 - Data Set G (Two-Tailed Test)

This Data set tests whether the population mean impurity differs between Agent1 and Agent2 using a Two-Tailed test.

	A	B	C	D	E	F	G	H
1	**Batch**	**Agent1**	**Agent2**	**Difference**	t-Test: Paired Two Sample for Means			
2	1	7,7	8,5	-0,8				
3	2	9,2	9,6	-0,4		*Agent1*	*Agent2*	
4	3	6,8	6,4	0,4	Mean	8,25	8,683333333	
5	4	9,5	9,8	-0,3	Variance	1,059090909	1,077878788	
6	5	8,7	9,3	-0,6	Observations	12	12	
7	6	6,9	7,6	-0,7	Pearson Correlation	0,901055812		
8	7	7,5	8,2	-0,7	Hypothesized Mean Difference	0		
9	8	7,1	7,7	-0,6	df	11		
10	9	8,7	9,4	-0,7	t Stat	-3,263938591		
11	10	9,4	8,9	0,5	P(T<=t) one-tail	0,003772997		
12	11	9,4	9,7	-0,3	t Critical one-tail	1,795884819		
13	12	8,1	9,1	-1	P(T<=t) two-tail	0,007545995		
14	Sum	99	104,2	-5,2	t Critical two-tail	2,20098516		
15								
16					Difference in Means	0,433333333		
17								

Figure 1. Data set 8.4G two-tailed test.

Does the population mean impurity differ between the two filtration agents?

Bearing in mind that the two-tailed test has a rejection region that is divided into two tails for sampling the distribution of the mean (Berenson et al, 2015:356). Looking at figure 1, we could conclude that Agent2 has a higher mean of 8.68 whereas Agent1 has a lower mean of 8.25.

The t Stat is -3.263 with 11 degrees of freedom while the p-value is 0.0075. It is likely that the t stat of -3.263 falls within the region of rejection rejection as 0.05 had been used for the region of non-rejection. If we was to say that the null hypothesis is to decide if the population mean impurity differs between agent1 and agent2, then this hypothesis would be rejected but the p-value is low which could argue against that.

Exercise 8.5 - Data Set G (One-Tailed Test)

This Data set tests whether the population mean impurity differs between Agent1 and Agent2 using a One-Tailed test.

	A	B	C	D	E	F	G	H
1	**Batch**	**Agent1**	**Agent2**	**Difference**	t-Test: Paired Two Sample for Means			
2	1	7,7	8,5	-0,8				
3	2	9,2	9,6	-0,4		*Agent1*	*Agent2*	
4	3	6,8	6,4	0,4	Mean	8,25	8,683333333	
5	4	9,5	9,8	-0,3	Variance	1,059090909	1,077878788	
6	5	8,7	9,3	-0,6	Observations	12	12	
7	6	6,9	7,6	-0,7	Pearson Correlation	0,901055812		
8	7	7,5	8,2	-0,7	Hypothesized Mean Difference	0		
9	8	7,1	7,7	-0,6	df	11		
10	9	8,7	9,4	-0,7	t Stat	-3,263938591		
11	10	9,4	8,9	0,5	P(T<=t) one-tail	0,003772997		
12	11	9,4	9,7	-0,3	t Critical one-tail	1,795884819		
13	12	8,1	9,1	-1	P(T<=t) two-tail	0,007545995		
14	Sum	99	104,2	-5,2	t Critical two-tail	2,20098516		
15								
16					Difference in Means	0,433333333		
17								

Figure 2. Data set 8.4G One-tailed test.

Is Agent 1 more effective?

Observing figure 2, these results are looking at an alternative hypothesis that asks if Agent1 is more effective? On that basis, a one-tailed test was used, according to Berenson et al (2015), a one-tailed test allows for an alternative hypothesis that focuses on a particular direction. Looking at the p-value, it appears to be 0.003 which is below the 0.05 level of significance.

Exercise 8.6 - Data Set C

This Data set observes whether the population mean income for males exceeds that of females by firstly, using an F-test Two-Sample for variances and then by running a t-Test: Two-sample assuming equal variance.

F-Test Two-Sample for Variances

	Variable 1	Variable 2
Mean	52,91333333	44,2333333
Variance	233,1289718	190,175819
Observations	60	60
df	59	59
F	1,225860221	
P(F<=f) one-tail	0,21824624	
F Critical one-tail	1,539956607	

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	52,91333333	44,2333333
Variance	233,1289718	190,175819
Observations	60	60
Pooled Variance	211,6523955	
Hypothesized Mean Difference	0	
df	118	
t Stat	3,267900001	
P(T<=t) one-tail	0,000709735	
t Critical one-tail	1,657869522	
P(T<=t) two-tail	0,00141947	
t Critical two-tail	1,980272249	
Difference in Means	8,68	

Figure 3. F-Test and t-Test results

Does the population mean income for males exceeds that of females.

Using the F-Test, we can test for variability and detect differences in two independent populations (Berenson et al, 2015). Using a one-tailed F-Test, we observe the mean via the observation of two groups of 60, with 59 degrees of freedom, we can see that males exceed females within mean income. We can also see that the F stat is 1,225 with a one-tailed p-value of 0.21 which supports a rejection of an alternative hypothesis that indicates that there is not a difference.

The t-test two-sample displays slightly different data due to it using a pooled-variance of the two variables.

References

Berenson, M.L., Levine, D. & Szabat, K.A. (2015) Basic Business Statistics: concepts and applications. 13ed. *Pearson Higher Ed*.