Stephen Hanna 109097796

HW8

Problem 1:

```
data ProcessingTime;
Input ProcessingTime @@;
datalines;
28 25 27 31 10 26 30 15 55 12 24 32 28 42 38
;
proc print data = ProcessingTime;
title 'Processing Time'
run;
proc univariate  data=ProcessingTime normal;
var ProcessingTime;
run ;
proc ttest h0=25 data=ProcessingTime sides=u alpha=.05;
var ProcessingTime;
run;
```

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	W	0.941665	Pr < W	0.4038
Kolmogorov-Smirnov	D	0.169887	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.07693	Pr > W-Sq	0.2177
Anderson-Darling	A-Sq	0.428232	Pr > A-Sq	>0.2500

p> .05 for normality testing, so the data is assumed to be normally distributed.

DF	t Value	Pr > t
14	1.08	0.1485

p>.05, so we do not reject the null hypothesis. The processing time is not significantly greater than 25 minutes.

Problem 2:

```
data Hypertension;
Input Temperature $ BloodPressure;
datalines;
26 152
26 157
26 179
26 182
26 176
26 149
5 384
```

```
5 369
5 354
5 375
5 366
5 423
;
proc print data = Hypertension;
title 'Temperature dependent influence on blood pressure'
run;
proc univariate   data=Hypertension normal;
var BloodPressure;
by Temperature;
run ;
proc ttest data=Hypertension sides=2 alpha=0.05 h0=0;
Class Temperature;
var BloodPressure;
run;
```

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	W	0.85134	Pr < W	0.1614
Kolmogorov-Smirnov	D	0.254371	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.077782	Pr > W-Sq	0.1896
Anderson-Darling	A-Sq	0.454293	Pr > A-Sq	0.1737

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	W	0.869398	Pr < W	0.2238
Kolmogorov-Smirnov	D	0.24254	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.0744	Pr > W-Sq	0.2112
Anderson-Darling	A-Sq	0.444501	Pr > A-Sq	0.1864

The shapiro test demonstrates that both sets of values for respective temperatures are normally distributed since p>.1 in both cases.

Temperature	N	Mean	Std Dev	Std Err	Minimum	Maximum
26	6	165.8	14.7705	6.0300	149.0	182.0
5	6	378.5	23.9562	9.7801	354.0	423.0
Diff (1-2)		-212.7	19.9006	11.4896		

Temperature	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
26		165.8	150.3	181.3	14.7705	9.2198	36.2263
5		378.5	353.4	403.6	23.9562	14.9537	58.7553
Diff (1-2)	Pooled	-212.7	-238.3	-187.1	19.9006	13.9049	34.9242
Diff (1-2)	Satterthwaite	-212.7	-239.0	-186.3			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	10	-18.51	<.0001
Satterthwaite	Unequal	8.3215	-18.51	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	5	5	2.63	0.3121

The p value for the equality of variances is greater than .05, so the two variances are assumed to not be statistically different. Thus, the pooled t test value will be used. The p value is less than .0001, so we can reject the null hypothesis and state that **the mean blood pressure at different temperatures is significantly different**

Problem 3:

```
data CornYield;
Input VarA $ VarB;
diff = varA - varB;
datalines;
48.2 41.5
44.6 40.1
49.7 44.0
40.5 41.2
54.6 49.8
47.1 41.7
51.4 46.8
;
proc print data = CornYield;
title 'Corn Yields for different varieties'
```

```
run;
proc univariate   data=CornYield;
var diff;
run;
```

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	4.908079	Pr > |t|	0.0027
Sign	M	2.5	Pr >= |M|	0.1250
Signed Rank	S	13	Pr >= |S|	0.0313

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.756933	Pr < W	0.0150
Kolmogorov-Smirnov	D	0.369078	Pr > D	<0.0100
Cramer-von Mises	W-Sq	0.153764	Pr > W-Sq	0.0166
Anderson-Darling	A-Sq	0.838808	Pr > A-Sq	0.0163

The data is paired. The data is not normal, since the p value is less than .05 for the shapiro- wilk test. Thus, we use the p value for the Wilcoxon signed rank test. The p value is less than .05, so we reject the null hypothesis and conclude, with over 95% confidence, that the means between the two yields are not the same.

Problem 4:

```
data SalesData;
Input Before $ After;
diff = after-before;
datalines;
12 18
18 24
25 24
9  14
14 19
16 20
;
proc print data = SalesData;
title 'Sales before and after training';
run;
proc univariate   data=SalesData normal;
var diff;
run;
```

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	3.866801	Pr > |t|	0.0118
Sign	M	2	Pr >= |M|	0.2188
Signed Rank	S	9.5	Pr >= |S|	0.0625

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.735678	Pr < W	0.0144
Kolmogorov-Smirnov	D	0.308159	Pr > D	0.0739
Cramer-von Mises	W-Sq	0.138153	Pr > W-Sq	0.0242
Anderson-Darling	A-Sq	0.77049	Pr > A-Sq	0.0211

The data is paired. The data is not normal, since the p value is less than .05 for the shapiro- wilk test. Thus, we use the p value for the Wilcoxon signed rank test. However, the p value has to be halved when testing whether one data set is greater than the other, rather than one ranked data set simply being significantly different than the other. Hence, the p value used is .0625/2, or .03125. The p value is greater than .01, so we cannot reject the null hypothesis. **The sales before cannot be concluded, with 99% confidence, to be significantly less than the sales after.**