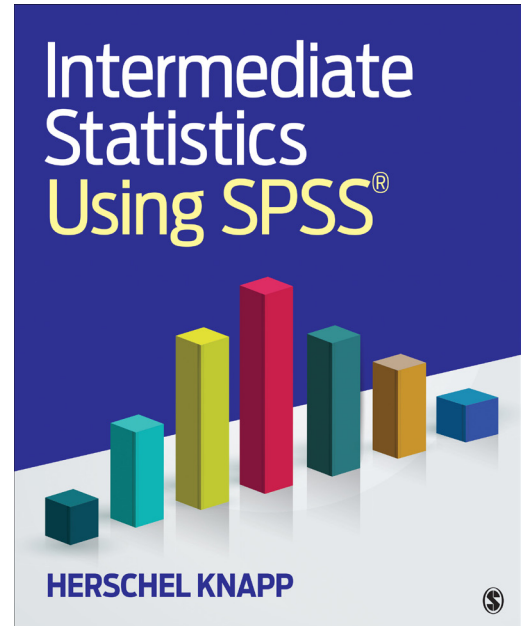


C H A P T E R 4

t Test and Mann-Whitney U Test

Solutions to
Odd-Numbered Exercises



Exercise	Page
4.1A	39
4.1B	42
4.3A	45
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4.5A	51
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4.7B	60
4.9A	63
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EXERCISE 4.1, DATA SET A

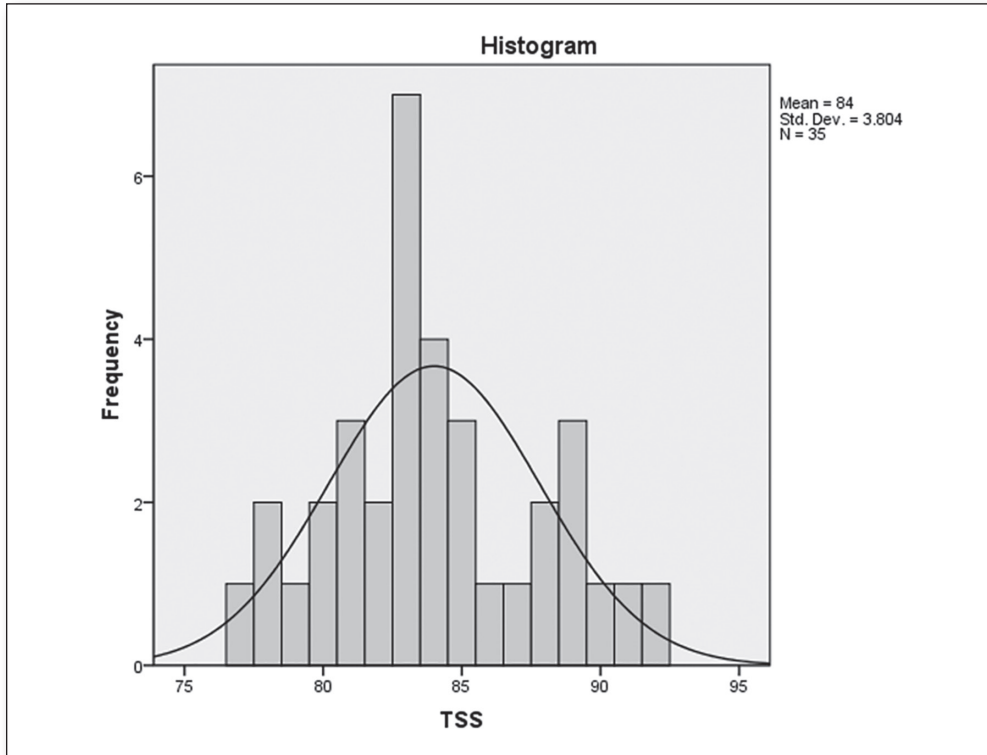
(a)

 H_0 : The number of students in a tutoring group has no effect on student satisfaction. H_1 : The number of students in a tutoring group has an effect on student satisfaction.

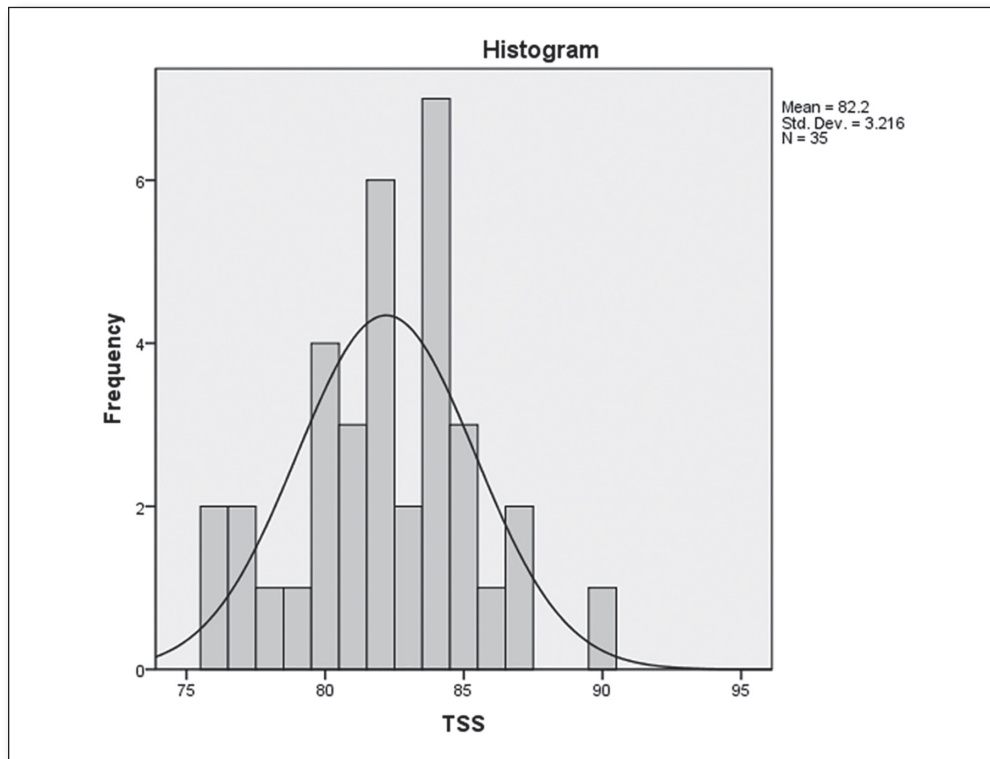
(b)

Histograms with normal curve plots show a normal distribution of *TSS* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *TSS* in Group 1 (One-to-one tutoring)



Normal distribution for *TSS* in Group 2 (Two-to-one tutoring)



Test of Homogeneity of Variances

TSS

Levene Statistic	df1	df2	Sig.
.829	1	68	.366

The homogeneity of variance score shows a significance (p) of .366; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group, as shown in the *Descriptives* table below is 35 for each group; since the n s are greater than 30, this criterion passes also.

(c)

The *t* test revealed the following:

Descriptives								
TSS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
					Lower Bound	Upper Bound	Minimum	Maximum
One-to-one	35	84.00	3.804	.643	82.69	85.31	77	92
Two-to-one	35	82.20	3.216	.544	81.10	83.30	76	90
Total	70	83.10	3.612	.432	82.24	83.96	76	92

ANOVA					
TSS					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.700	1	56.700	4.570	.036
Within Groups	843.600	68	12.406		
Total	900.300	69			

The mean Tutor Satisfaction Survey score for Group 1 (One-to-one) is 84.00, whereas the mean Tutor Satisfaction Survey score for Group 2 (Two-to-one) is 82.20. This 1.8-point difference is statistically significant since the significance (*p*) is .036 (which is less than the .05 α level).

(d)

This study analyzed the level of tutoring satisfaction based on tutor group size. The 70 students were randomly assigned to one of two groups; students in group 1 had one student assigned to a tutor, and group 2 had two students assigned to a tutor. At the end of the term, all students completed the Tutor Satisfaction Survey (TSS), which renders a score ranging from 0 (very unsatisfied) to 100 (very satisfied). Results revealed a mean score of 84.0 (SD = 3.8) for group 1, and 82.2 (SD = 3.2) for students in group 2. Using a .05 α level, the *p* value of .036 suggests that there is a statistically significant difference between these scores, hence, we reject H_0 . These findings suggest support for H_1 , specifically, that tutor group size has an effect on student satisfaction.

EXERCISE 4.1, DATA SET B

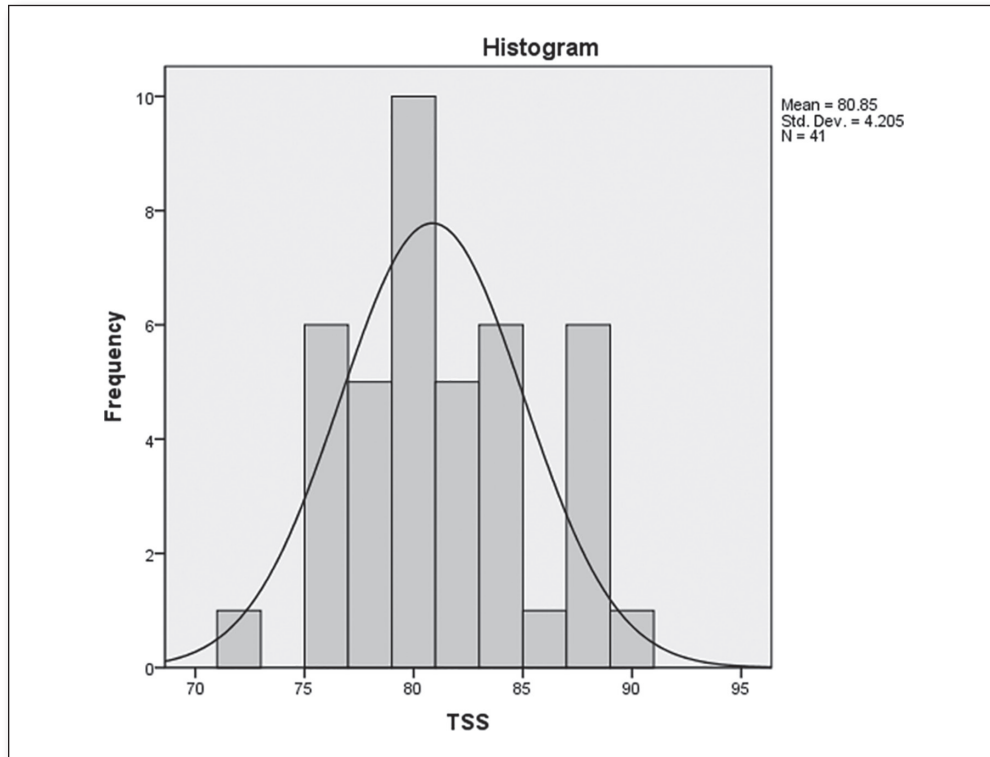
(a)

 H_0 : The number of students in a tutoring group has no effect on student satisfaction. H_1 : The number of students in a tutoring group has an effect on student satisfaction.

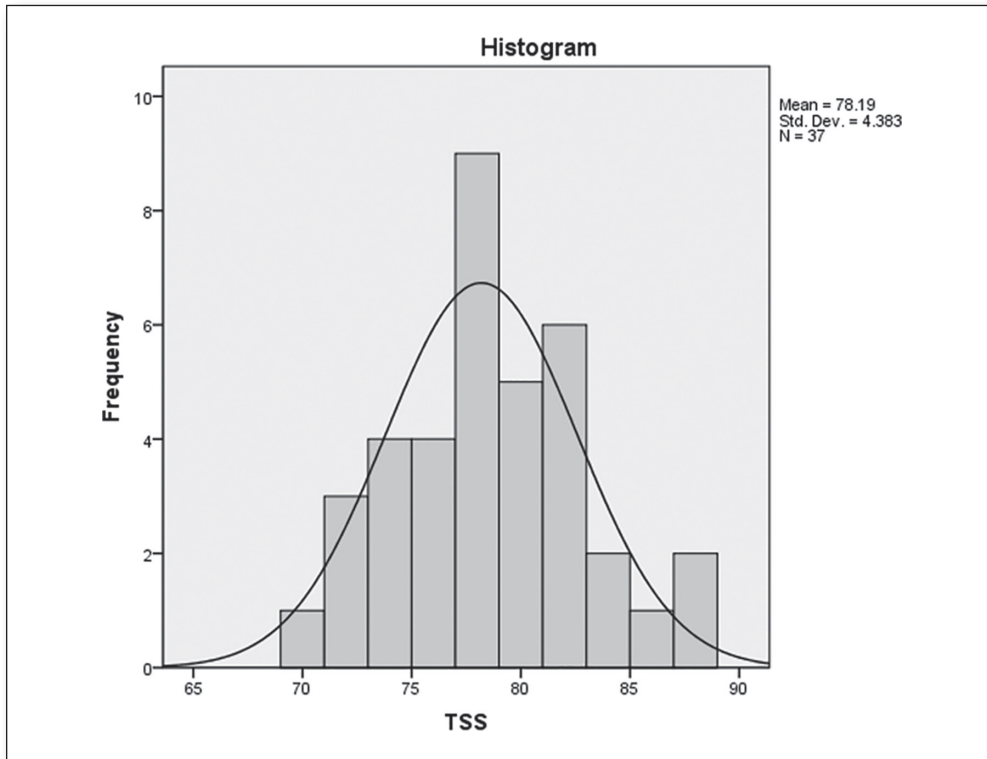
(b)

Histograms with normal curve plots show a normal distribution of *TSS* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *TSS* in Group 1 (One-to-one tutoring)



Normal distribution for *TSS* in Group 2 (Two-to-one tutoring)



Test of Homogeneity of Variances

TSS

Levene Statistic	df1	df2	Sig.
.009	1	76	.925

The homogeneity of variance score shows a significance (p) of .925; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group, as shown in the *Descriptives* table below is 35 for each group; since the n s are greater than 30, this criterion passes also.

(c)

The t test revealed the following:

Descriptives								
TSS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
One-to-one	41	80.85	4.205	.657	79.53	82.18	72	90
Two-to-one	37	78.19	4.383	.721	76.73	79.65	70	87
Total	78	79.59	4.468	.506	78.58	80.60	70	90

ANOVA					
TSS					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	138.074	1	138.074	7.502	.008
Within Groups	1398.798	76	18.405		
Total	1536.872	77			

The mean Tutor Satisfaction Survey score for Group 1 (One-to-one) is 80.85, whereas the mean Tutor Satisfaction Survey score for Group 2 (Two-to-one) is 78.19. This 2.39-point difference is statistically significant since the significance (p) is .008 (which is less than the .05 α level).

(d)

This study analyzed the level of tutoring satisfaction based on tutor group size. The 78 students were randomly assigned to one of two groups; students in group 1 had one student assigned to a tutor, and group 2 had two students assigned to a tutor. At the end of the term, all students completed the Tutor Satisfaction Survey (TSS), which renders a score ranging from 0 (very unsatisfied) to 100 (very satisfied). Results revealed a mean score of 80.85 ($SD = 4.21$) for group 1, and 78.19 ($SD = 4.38$) for students in group 2. Using a .05 α level, the p value of .008 suggests that there is a statistically significant difference between these scores, hence, we reject H_0 . These findings suggest support for H_1 , specifically, that tutor group size has an effect on student satisfaction.

EXERCISE 4.3, DATA SET A

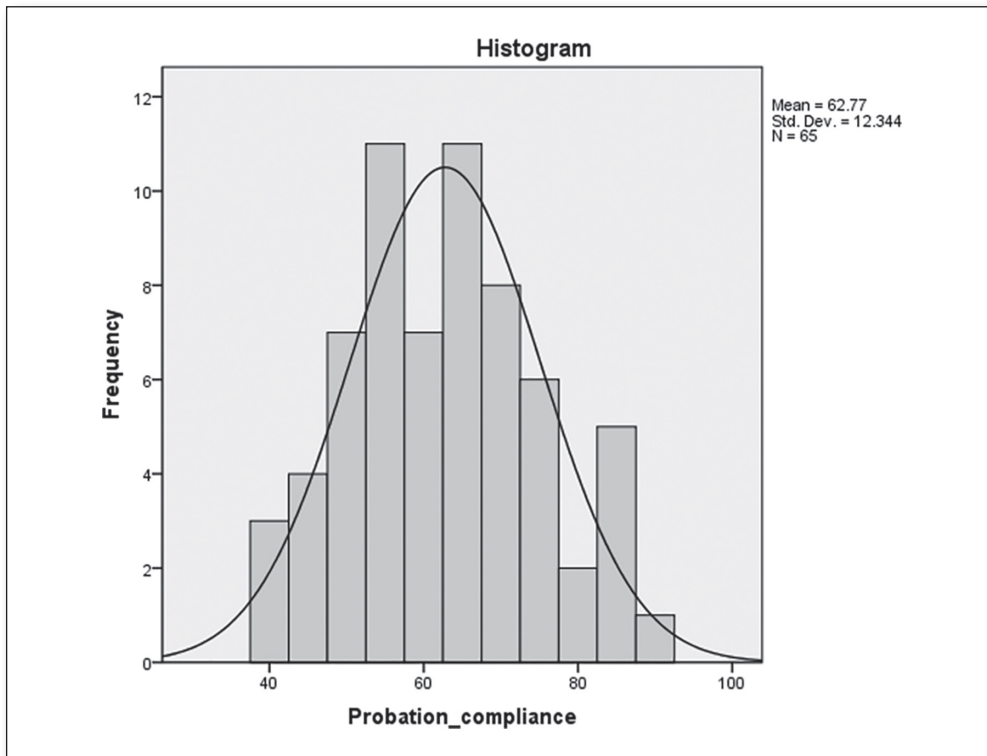
(a)

 H_0 : Having a mentor will have no effect on probation compliance. H_1 : Having a mentor will have an effect on probation compliance.

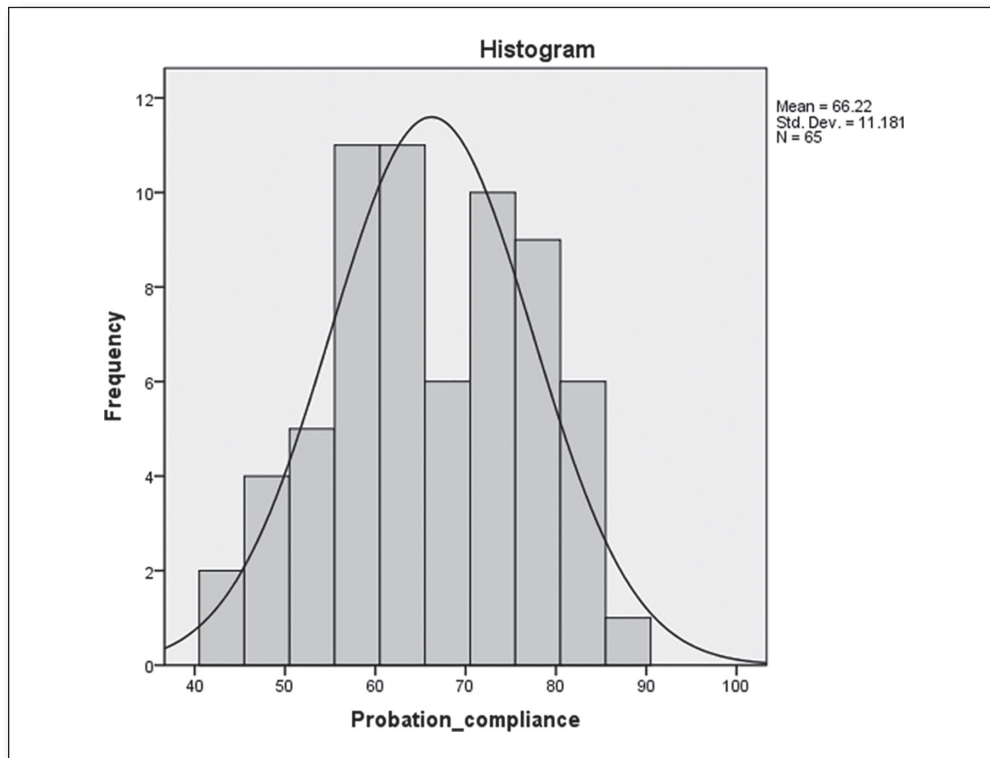
(b)

The Histograms with normal curve plots show a normal distribution of the *Probation_compliance* variable for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Probation_compliance* in Group 1 (No mentor)



Normal distribution for *Probation_compliance* in Group 2 (Peer mentor)



Test of Homogeneity of Variances

Probation_compliance

Levene Statistic	df1	df2	Sig.
.267	1	128	.606

The homogeneity of variance score for *Depress* shows a significance (p) of .606; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 65 (see *Descriptives* table below), which satisfies the 30 per group minimum criterion.

(c)

The *t* test revealed the following:

Descriptives								
Probation_compliance								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
No mentor	65	62.77	12.344	1.531	59.71	65.83	40	89
Peer mentor	65	66.22	11.181	1.387	63.44	68.99	43	87
Total	130	64.49	11.858	1.040	62.43	66.55	40	89

ANOVA					
Probation_compliance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	385.969	1	385.969	2.783	.098
Within Groups	17752.523	128	138.692		
Total	18138.492	129			

The mean probation compliance in the control group (No mentor) is 62.77, whereas those in the treatment group (Peer mentor) had a mean probation compliance of 66.22. Since the significance (*p*) is .098 (which is greater than the .05 α level), the 3.45-point improvement in those who had a peer mentor is considered to be statistically insignificant. As such, we would reject H_1 in favor of H_0 .

(d)

A judge appointed us to evaluate the effectiveness of a new mentorship program for juvenile offenders with priors. Among the 130 juveniles, half were randomly assigned to have no mentor; the other half were assigned to a trained peer mentor, who is 3 to 5 years older than the offender. Those with no mentorship had a mean probation compliance score of 62.77 (SD = 12.34), whereas those who worked with a peer mentor had a mean probation compliance score of 66.22 (SD = 11.18). This 3.45-point difference was found to be statistically insignificant ($p = .098$). Based on these findings, we would accept H_0 and reject H_1 . Since the numbers appear to be moving in the desired direction, we will propose reviewing and revising the mentor training and recruitment protocols.

EXERCISE 4.3, DATA SET B

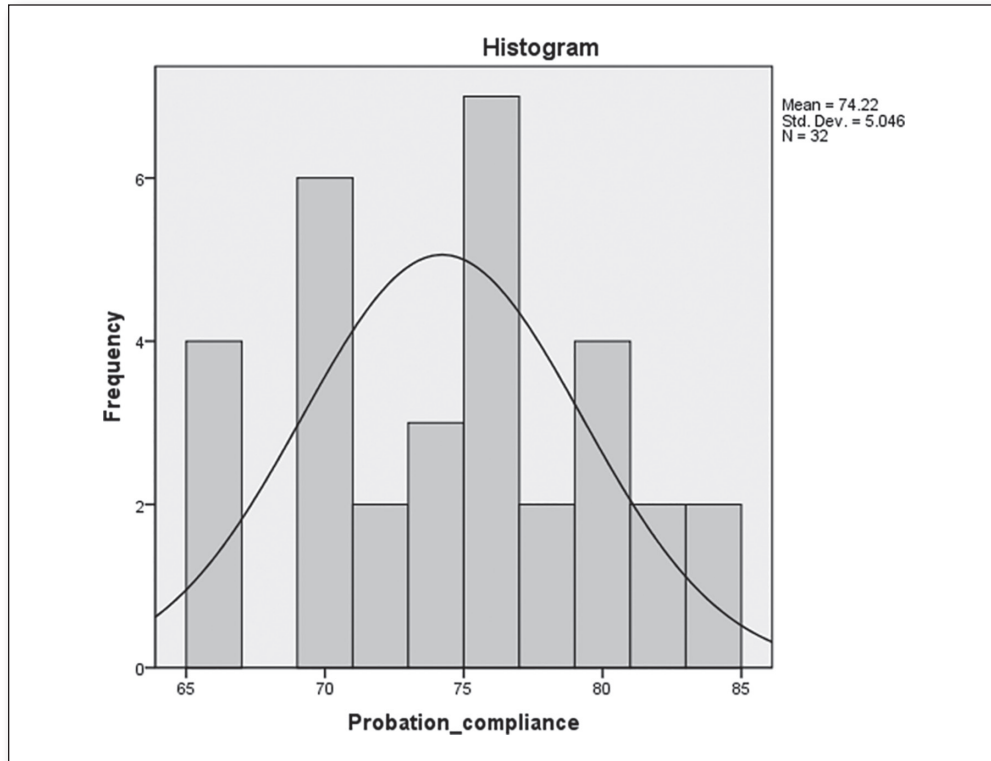
(a)

 H_0 : Having a mentor will have no effect on probation compliance. H_1 : Having a mentor will have an effect on probation compliance.

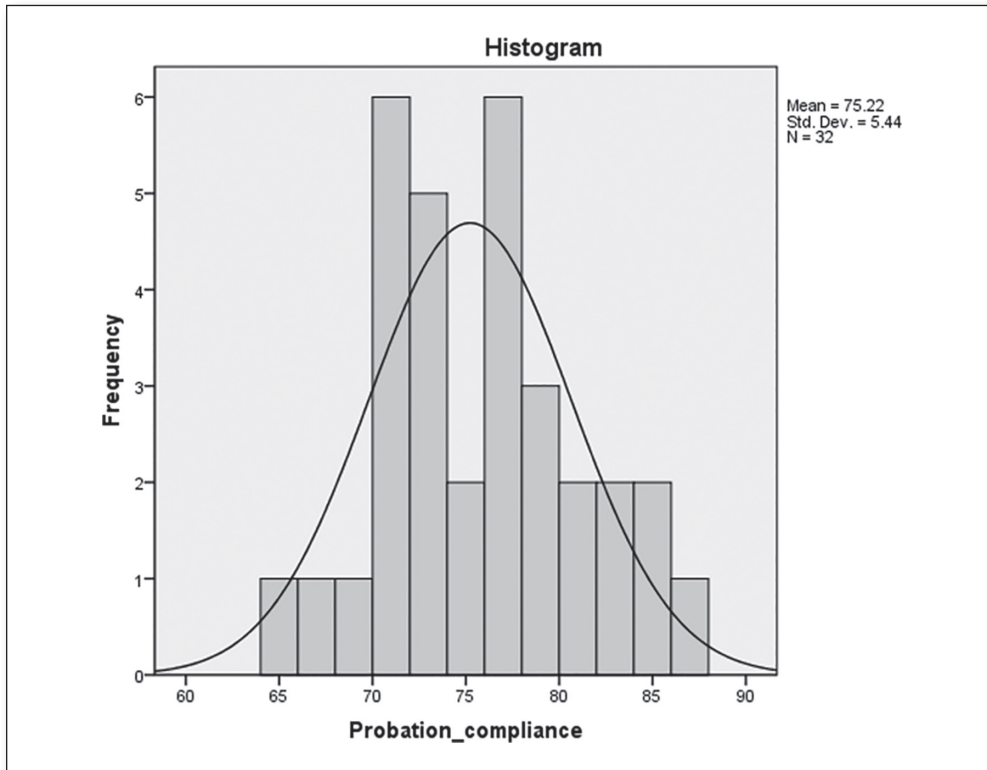
(b)

The Histograms with normal curve plots show a normal distribution of the *Probation_compliance* variable for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Probation_compliance* in Group 1 (No mentor)



Normal distribution for *Probation_compliance* in Group 2 (Peer mentor)



Test of Homogeneity of Variances

Probation_compliance

Levene Statistic	df1	df2	Sig.
.036	1	62	.851

The homogeneity of variance score for *Depress* shows a significance (p) of .851; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 32 (see *Descriptives* table below), which satisfies the 30 per group minimum criterion.

(c)

The t test revealed the following:

Descriptives								
Probation compliance								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
No mentor	32	74.22	5.046	.892	72.40	76.04	66	84
Peer mentor	32	75.22	5.440	.962	73.26	77.18	65	86
Total	64	74.72	5.230	.654	73.41	76.03	65	86

ANOVA					
Probation compliance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16.000	1	16.000	.581	.449
Within Groups	1706.938	62	27.531		
Total	1722.938	63			

The mean probation compliance in the control group (No mentor) is 74.22, whereas those in the treatment group (Peer mentor) had a mean probation compliance of 75.22. Since the significance (p) is .449 (which is greater than the .05 α level), the 1-point improvement in those who had a peer mentor is considered to be statistically insignificant. As such, we would reject H_1 in favor of H_0 .

(d)

A judge appointed us to evaluate the effectiveness of a new mentorship program for juvenile offenders with priors. Among the 64 juveniles, half were randomly assigned to have no mentor; the other half were assigned to a trained peer mentor, who is 3 to 5 years older than the offender. Those with no mentorship had a mean probation compliance score of 74.22 ($SD = 5.05$), whereas those who worked with a peer mentor had a mean probation compliance score of 75.22 ($SD = 5.44$). This 1-point difference was found to be statistically insignificant ($p = .449$). Based on these findings, we would accept H_0 and reject H_1 . Since the numbers appear to be moving in the desired direction, we will propose reviewing and revising the mentor training and recruitment protocols.

EXERCISE 4.5, DATA SET A

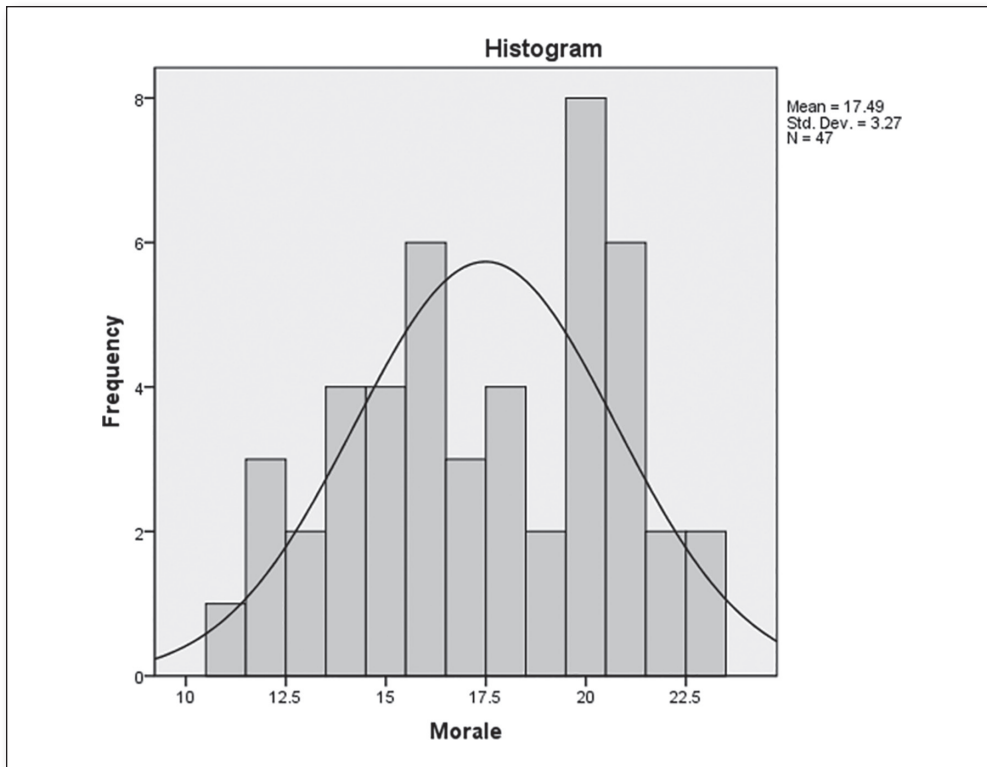
(a)

 H_0 : Increasing paid time off will not affect employee morale. H_1 : Increasing paid time off will affect employee morale.

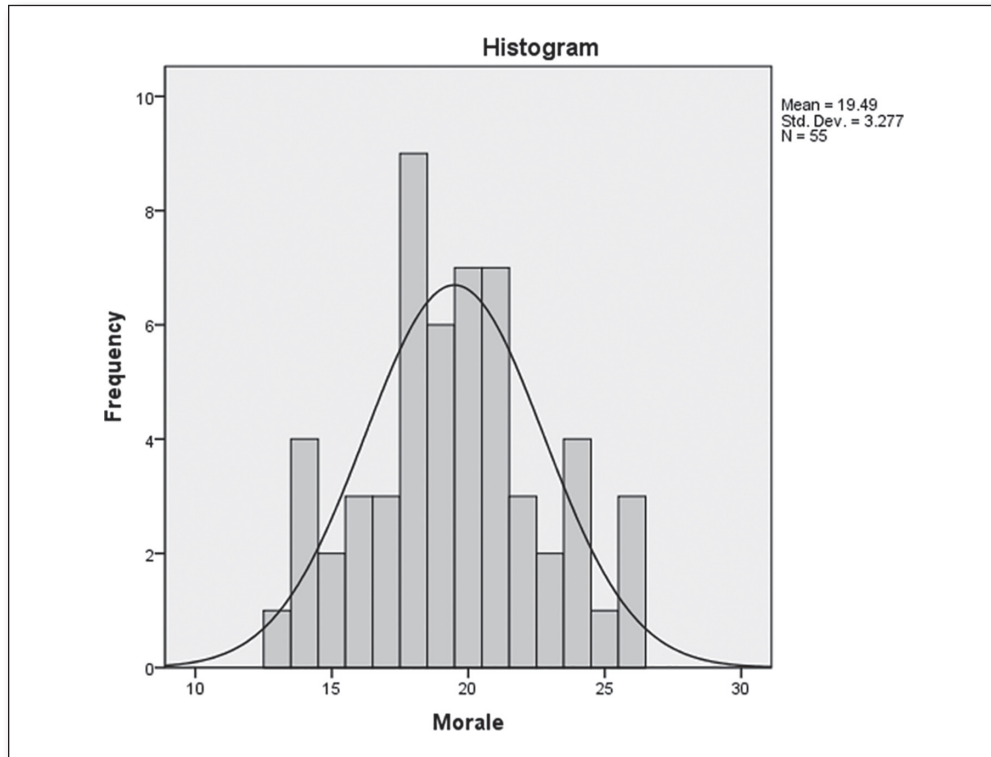
(b)

The histograms (below) for both groups show normal distributions of *Morale*, hence the pretest criterion of normality is satisfied.

Site 1—2 Weeks PTO (Paid Time Off)



Site 2—2 Weeks PTO (Paid Time Off) + 4th Friday of the month off



Test of Homogeneity of Variances

Morale

Levene Statistic	df1	df2	Sig.
.347	1	100	.557

The homogeneity of variance score shows a significance (p) of .557; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the groups; hence, this pretest criterion passes. The n for each group, as shown in the *Descriptives* table below is greater than 30; the n quotas are satisfied.

(c)

The *t* test revealed the following:

Descriptives								
Morale								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
					Lower Bound	Upper Bound	Minimum	Maximum
2 Weeks PTO	47	17.49	3.270	.477	16.53	18.45	11	23
2 Weeks PTO + 4th Fridays off	55	19.49	3.277	.442	18.61	20.38	13	26
Total	102	18.57	3.408	.337	17.90	19.24	11	26

ANOVA					
Morale					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	101.529	1	101.529	9.476	.003
Within Groups	1071.490	100	10.715		
Total	1173.020	101			

The mean employee morale for site 1 (2 weeks PTO) is 17.49, whereas the mean morale for site 2 (2 weeks PTO + every 4th Friday off) is 19.49. This 2-point difference is statistically significant since the significance (*p*) is .003 (which is less than the .05 level).

(d)

In order to assess methods of improving employee morale, we conducted a two-site study: The 47 employees who received 2 weeks of PTO (Paid Time Off) per year scored a mean of 17.49 (SD = 3.27) on the Acme Morale Scale, wherein 1 = extremely low morale, and 25 = extremely high morale. The 55 employees at site 2 received the same 2 weeks of PTO per year plus the last Friday of each month off (with pay); their mean morale score was 19.49 (SD = 3.28). This 2 point difference is statistically significant (*p* = .003), hence, we reject H_0 in favor of H_1 —specifically, the extra day off at the end of each month appears to have a positive effect on employee morale.

EXERCISE 4.5, DATA SET B

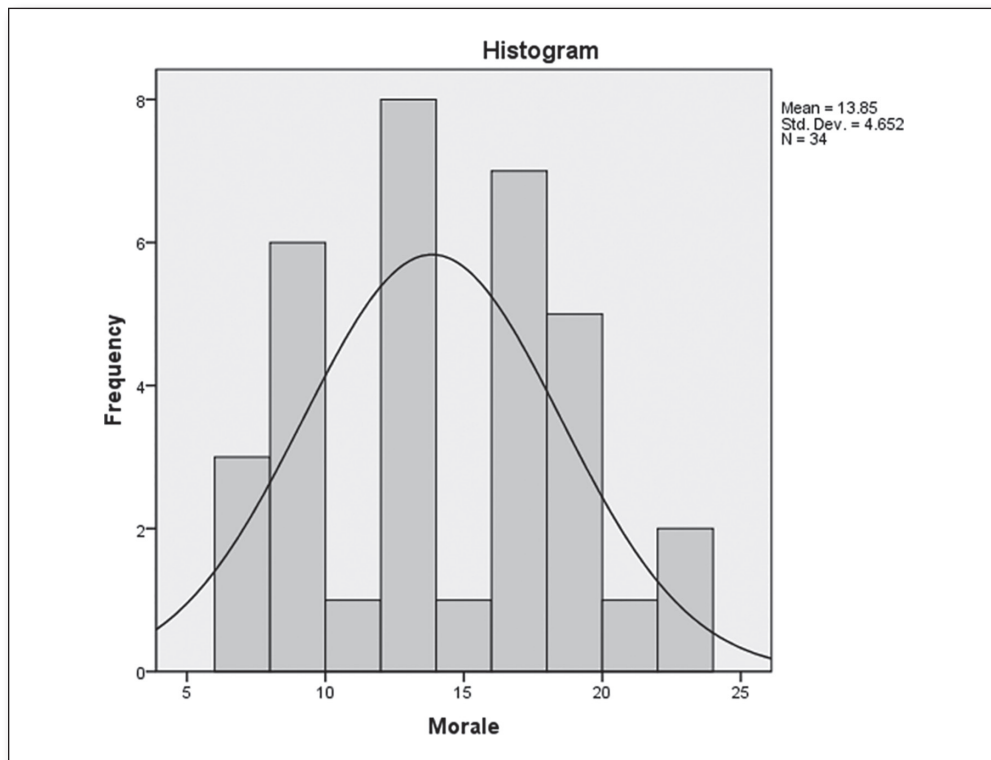
(a)

 H_0 : Increasing paid time off will not affect employee morale. H_1 : Increasing paid time off will affect employee morale.

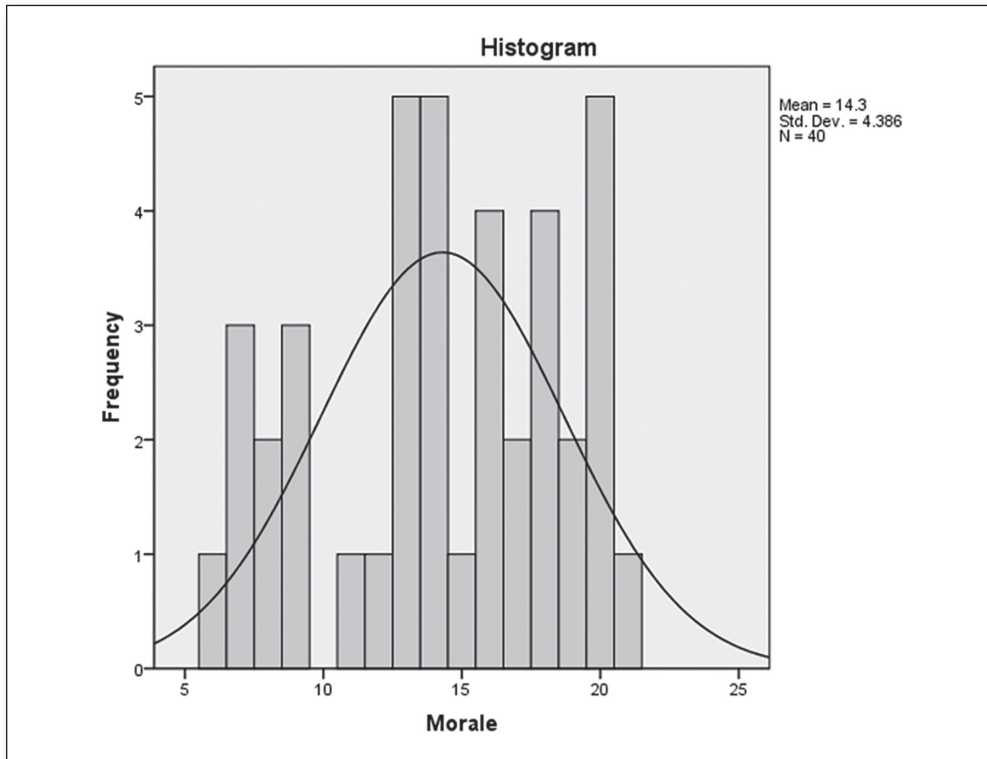
(b)

The histograms (below) for both groups show normal distributions of *Morale*, hence the pretest criterion of normality is satisfied.

Site 1—2 Weeks PTO (Paid Time Off)



Site 2—2 Weeks PTO (Paid Time Off) + 4th Friday of the month off



Test of Homogeneity of Variances

Morale

Levene Statistic	df1	df2	Sig.
.259	1	72	.612

The homogeneity of variance score shows a significance (p) of .612; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the groups; hence, this pretest criterion passes. The n for each group, as shown in the *Descriptives* table below is greater than 30; the n quotas are satisfied.

(c)

The t test revealed the following:

Descriptives									
Morale									
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			Minimum	Maximum
					Lower Bound	Upper Bound			
2 Weeks PTO	34	13.85	4.652	.798	12.23	15.48		7	23
2 Weeks PTO + 4th Fridays off	40	14.30	4.386	.694	12.90	15.70		6	21
Total	74	14.09	4.485	.521	13.06	15.13		6	23

ANOVA						
Morale						
	Sum of Squares	df	Mean Square	F	Sig.	
Between Groups	3.673	1	3.673	.181	.672	
Within Groups	1464.665	72	20.343			
Total	1468.338	73				

The mean employee morale for Group 1 (2 weeks PTO) is 13.85, whereas Group 2 (2 weeks PTO + every 4th Friday off) is 14.30. This .45-point difference is statistically insignificant since the significance (p) is .672 (which is greater than the .05 α level).

(d)

In order to assess methods of improving employee morale, we conducted a two-site study: The 34 employees who received 2 weeks of PTO (Paid Time Off) per year scored a mean of 13.85 (SD = 4.65) on the Acme Morale Scale, wherein 1 = extremely low morale, and 25 = extremely high morale. The 40 employees at site 2 received the same 2 weeks of PTO per year plus the last Friday of each month off (with pay); their mean morale score was 14.30 (SD = 4.39). This .45 point difference is statistically insignificant ($p = .672$), hence, we reject H_1 in favor of H_0 —specifically, the extra day off at the end of each month appears to have minor, insignificant (positive) effect on employee morale.

EXERCISE 4.7, DATA SET A

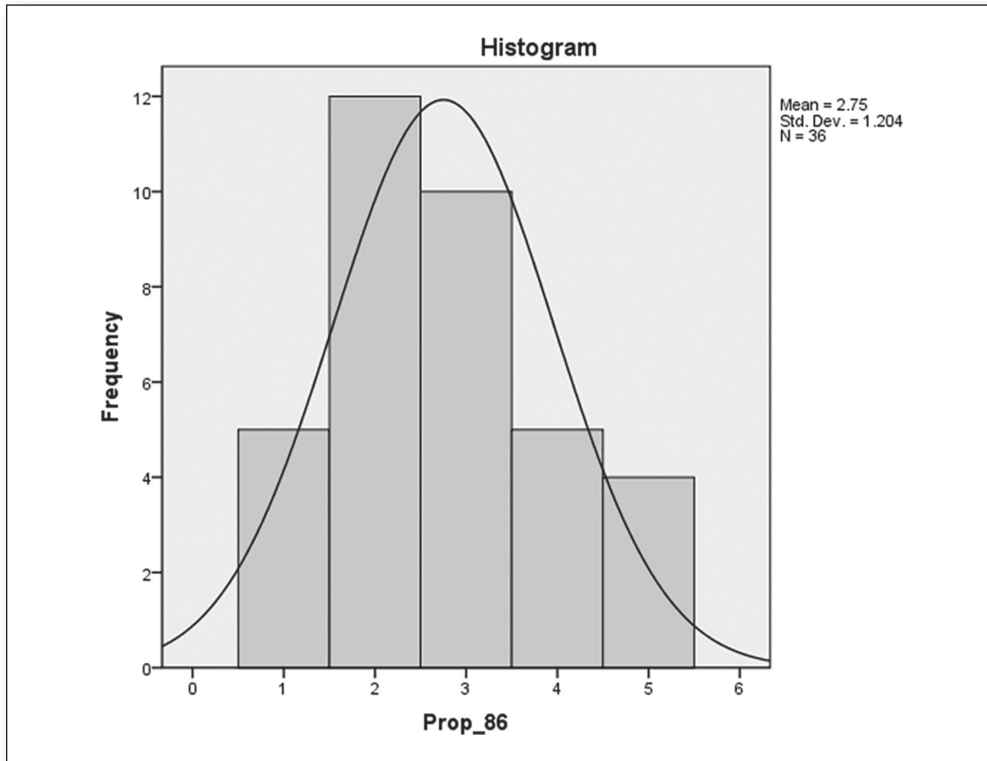
(a)

 H_0 : Advertising media will not influence voter choice. H_1 : Advertising media will influence voter choice.

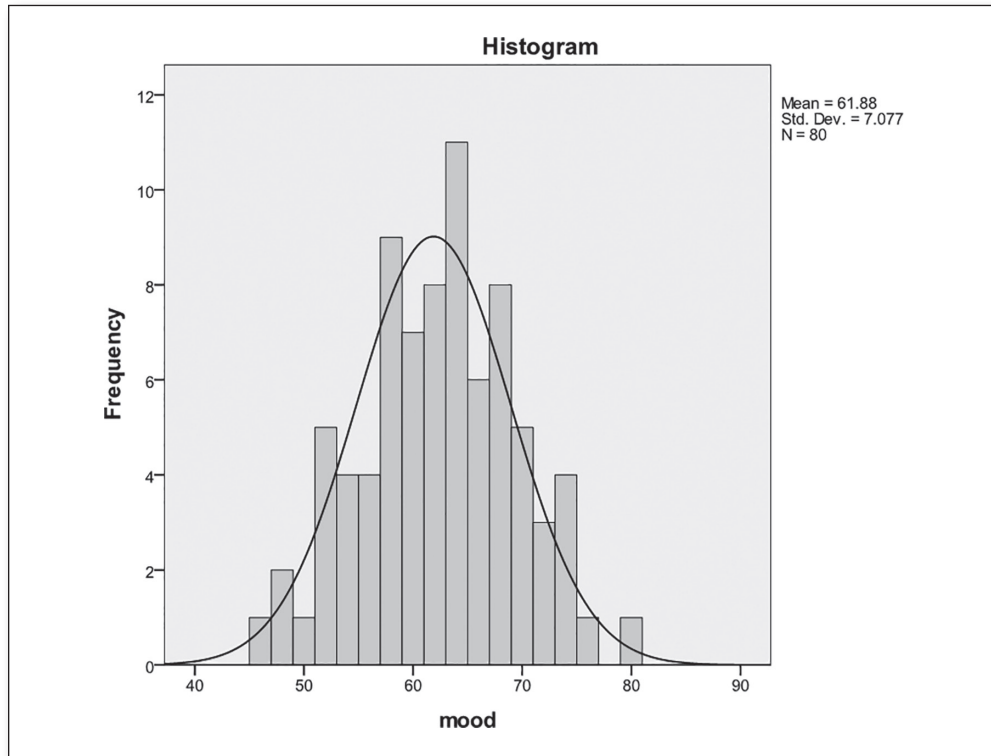
(b)

Histograms with normal curve plots show a normal distribution of *Prop_86* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Prop_86* in Group 1 (Control group)



Normal distribution for *Prop_86* in Group 2 (Print group)



Test of Homogeneity of Variances

Prop_86

Levene Statistic	df1	df2	Sig.
4.391	1	67	.040

The homogeneity of variance score for *Prop_86* shows a significance (p) of .040; since this is less than the α level of .05, this indicates that there is a statistically significant difference between the variances of the two groups, hence, this criterion is not satisfied and this should be mentioned in the discussion section.

The n for each group is greater than 30 in each group, which satisfies the 30 per group minimum criterion (see *Descriptives* table below).

(c) The *t* test revealed the following:

Descriptives									
Prop_86									
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			Minimum	Maximum
					Lower Bound	Upper Bound			
Control	36	2.75	1.204	.201	2.34	3.16		1	5
Print	33	3.42	1.733	.302	2.81	4.04		1	7
Total	69	3.07	1.508	.182	2.71	3.43		1	7

ANOVA					
Prop_86					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.827	1	7.827	3.572	.063
Within Groups	146.811	67	2.191		
Total	154.638	68			

The mean voter likelihood level for those in the Print (advertisement) group was 3.42, which is .67 points higher than the mean score of those in the control group (2.75), however since the significance (*p*) value is .063 (which is greater than the .05 α level) this difference is considered to be statistically insignificant.

(d)

In order to determine if a print advertisement would be effective in encouraging people to vote yes on Proposition 86, we convened a focus group consisting of registered voters. Participants were randomly assigned to two groups; the 36 members of the control group were shown no media, and the 33 members of the other group were shown a print advertisement, highlighting the benefits of Proposition 86. Both groups were then asked to indicate on a 1 to 7 scale the likelihood of them voting yes on Proposition 86 (1 = will definitely vote no . . . 7 = will definitely vote yes). The mean score from the control group was 2.75 (SD = 1.20), and the print media group had a mean of 3.42 (SD = 1.73). This .067 point difference was found to be statistically insignificant ($p = .063$). We reject H_1 and accept H_0 . These findings suggest that the print advertisement requires revision. The homogeneity of variance pretest assessment produced a *p* value of .040, suggesting that there was an unexpected statistically significant difference in the variance of the groups. Ideally, this value should be greater than .05. As such, these findings may be slightly compromised.

EXERCISE 4.7, DATA SET B

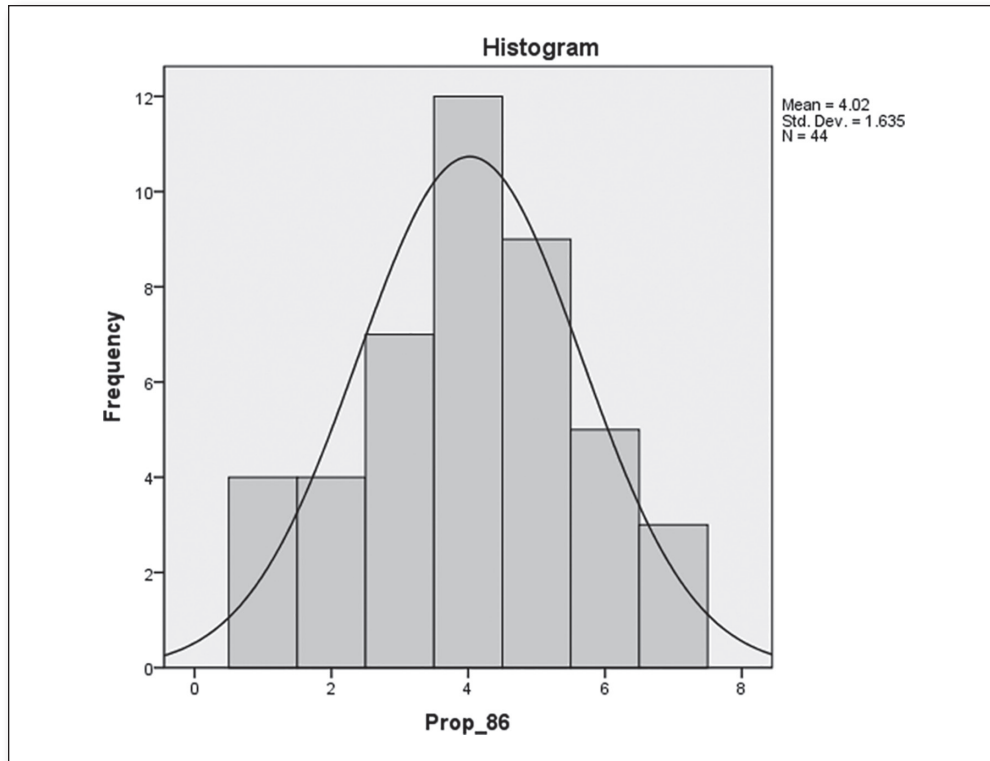
(a)

 H_0 : Advertising media will not influence voter choice. H_1 : Advertising media will influence voter choice.

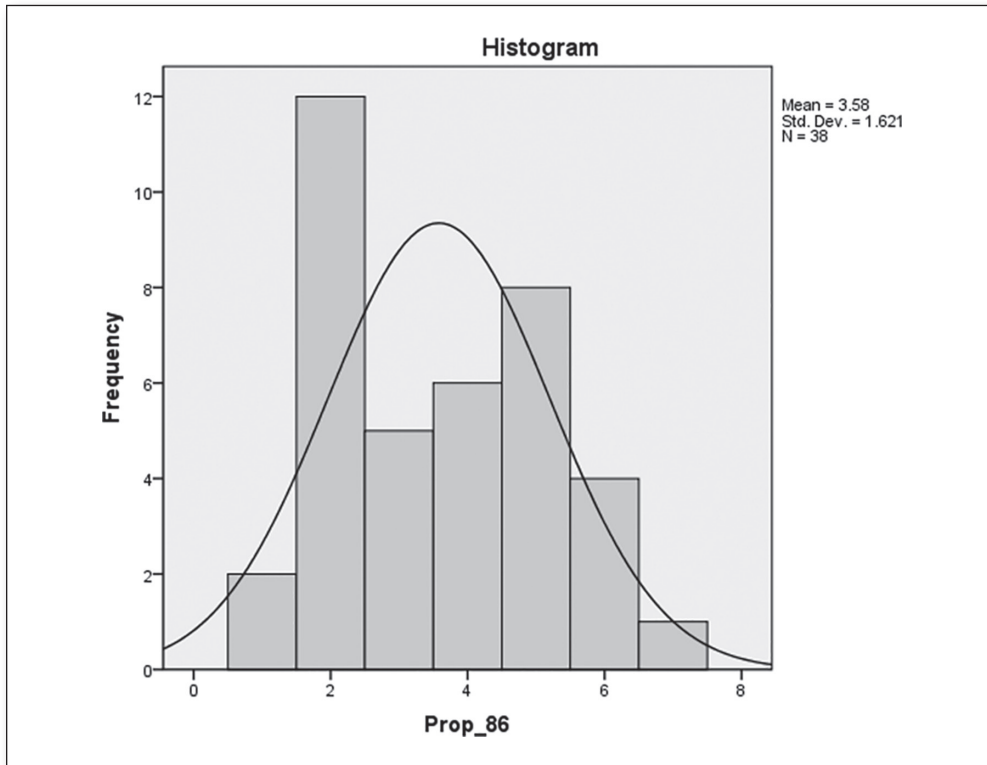
(b)

Histograms with normal curve plots show a normal distribution of *Prop_86* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Prop_86* in Group 1 (Control group)



Normal distribution for *Prop_86* in Group 2 (Print group)



Test of Homogeneity of Variances

Prop_86

Levene Statistic	df1	df2	Sig.
.678	1	80	.413

The homogeneity of variance score shows a significance (p) of .413; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the groups; hence, this pretest criterion passes.

The n for each group is greater than 30 in each group, which satisfies the 30 per group minimum criterion (see *Descriptives* table below).

(c) The t test revealed the following:

Descriptives								
Prop. 86								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	44	4.02	1.635	.247	3.53	4.52	1	7
Print	38	3.58	1.621	.263	3.05	4.11	1	7
Total	82	3.82	1.634	.180	3.46	4.18	1	7

ANOVA					
Prop. 86					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.016	1	4.016	1.514	.222
Within Groups	212.240	80	2.653		
Total	216.256	81			

The mean voter likelihood level for those in the Print (advertisement) group was 3.58, which is .44 points lower than the mean score of those in the control group (4.02), however since the significance (p) value is .222 (which is greater than the .05 level) this difference is considered to be statistically insignificant.

(d)

In order to determine if a print advertisement would be effective in encouraging people to vote yes on Proposition 86, we convened a focus group consisting of registered voters. Participants were randomly assigned to two groups; the 44 members of the control group were shown no media, and the 38 members of the other group were shown a print advertisement, highlighting the benefits of Proposition 86. Both groups were then asked to indicate on a 1 to 7 scale the likelihood of them voting yes on Proposition 86 (1 = will definitely vote no . . . 7 = will definitely vote yes). The mean score from the control group was 4.02 (SD = 1.64), and the print media group had a mean of 3.58 (SD = 1.62). Contrary to our expectations, on average, participants who were shown the print ad scored .44 points lower than those in the control group, who were shown no media. This difference was found to be statistically insignificant ($p = .222$), hence, we reject H_1 and accept H_0 . These findings suggest that the print advertisement requires considerable revision(s).

EXERCISE 4.9, DATA SET A

(a)

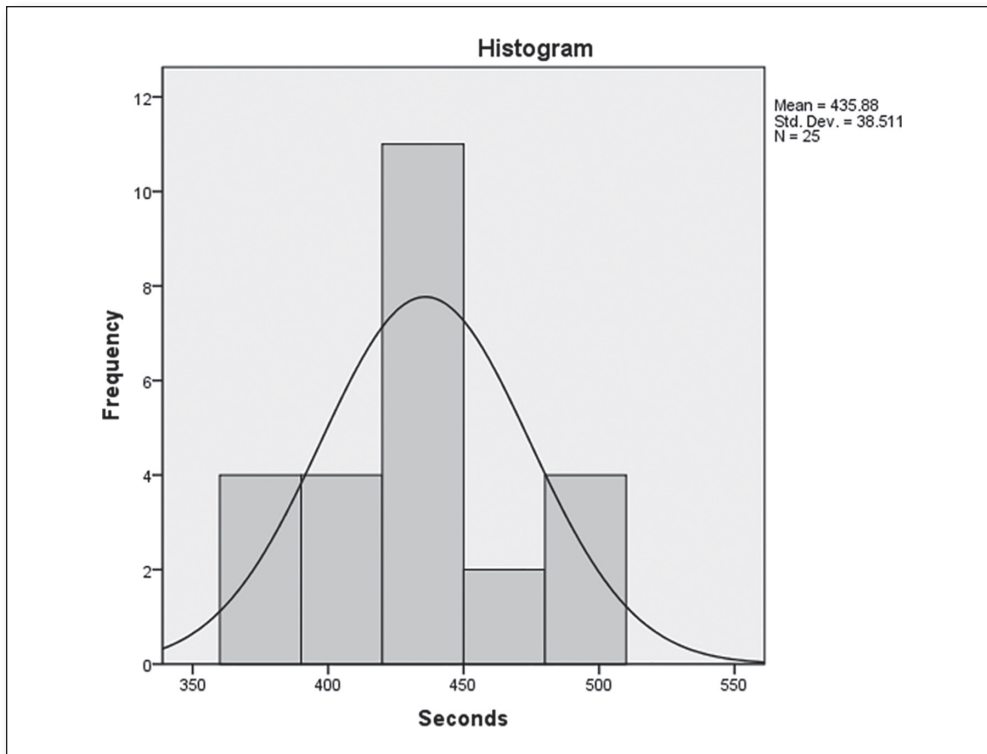
H_0 : The Acme reading lamp is no different from regular room lighting when it comes to reading speed.

H_1 : The Acme reading lamp facilitates faster reading speed than regular room lighting.

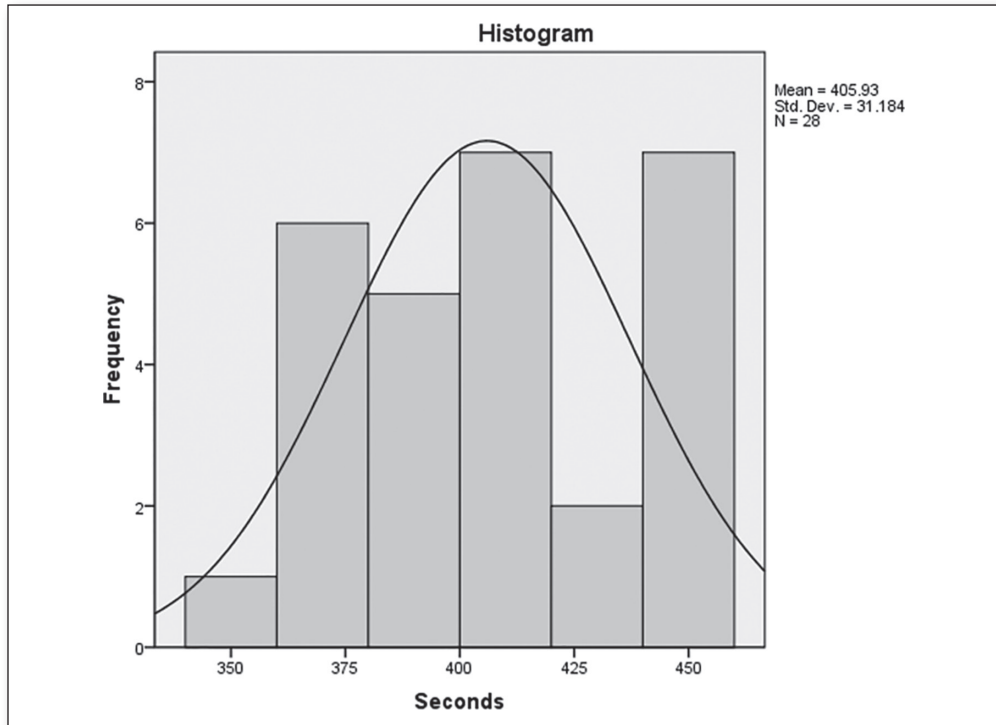
(b)

Histograms with normal curve plots show a normal distribution of *seconds* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Seconds* in Group 1 (Room lighting)



Normal distribution for *Seconds* in Group 2 (Acme reading lamp)



Test of Homogeneity of Variances

Seconds

Levene Statistic	df1	df2	Sig.
.231	1	51	.633

The homogeneity of variance score for *Seconds* shows a significance (p) of .633; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The Room lighting group had an n of 25, and the Acme lamp group had an n of 28 (see *Descriptives* table below); these figures are close to the minimal quota of 30 per group. The findings of the t test would be more robust if the n s were slightly higher for these groups.

(c)

The *t* test revealed the following:

Descriptives								
Seconds								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Room lighting	25	435.88	38.511	7.702	419.98	451.78	374	509
Acme lamp	28	405.93	31.184	5.893	393.84	418.02	357	455
Total	53	420.06	37.647	5.171	409.68	430.43	357	509

ANOVA						
Seconds						
	Sum of Squares	df	Mean Square	F	Sig.	
Between Groups	11848.333	1	11848.333	9.770	.003	
Within Groups	61850.497	51	1212.755			
Total	73698.830	52				

The mean reading time for Group 1 (Room lighting) is 436 seconds (rounded), whereas the mean reading time for Group 2 (Acme reading lamp) is 406 seconds (rounded). This 30-second difference is statistically significant since the significance (*p*) is .003 (which is less than the .05 α level).

(d)

This study analyzed the effects that the Acme reading lamp had on reading speed. The 53 subjects were randomly assigned to one of two groups; one group read a 1,000 word essay using regular room lighting, and the other group read the same essay using the new Acme reading lamp. Results revealed that on the average, those who read using the Acme reading lamp completed the essay 30 seconds earlier than those who used regular room lighting to read the essay (406 seconds vs. 436 seconds, respectively). Using a .05 α level, the *p* value of .003 suggests that the Acme reading lamp facilitates prompter reading speeds; hence, we reject H_0 . These findings suggest support for H_1 ; specifically, that the Acme reading lamp enhances reading rates.

EXERCISE 4.9, DATA SET B

(a)

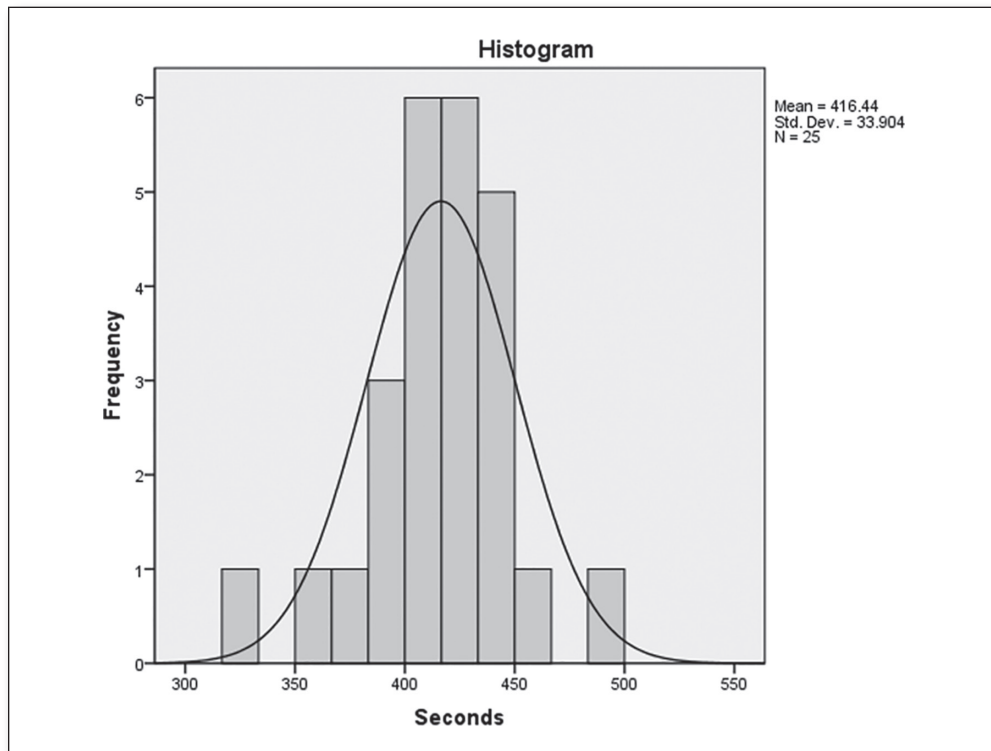
H_0 : The Acme reading lamp is no different from regular room lighting when it comes to reading speed.

H_1 : The Acme reading lamp facilitates faster reading speed than regular room lighting.

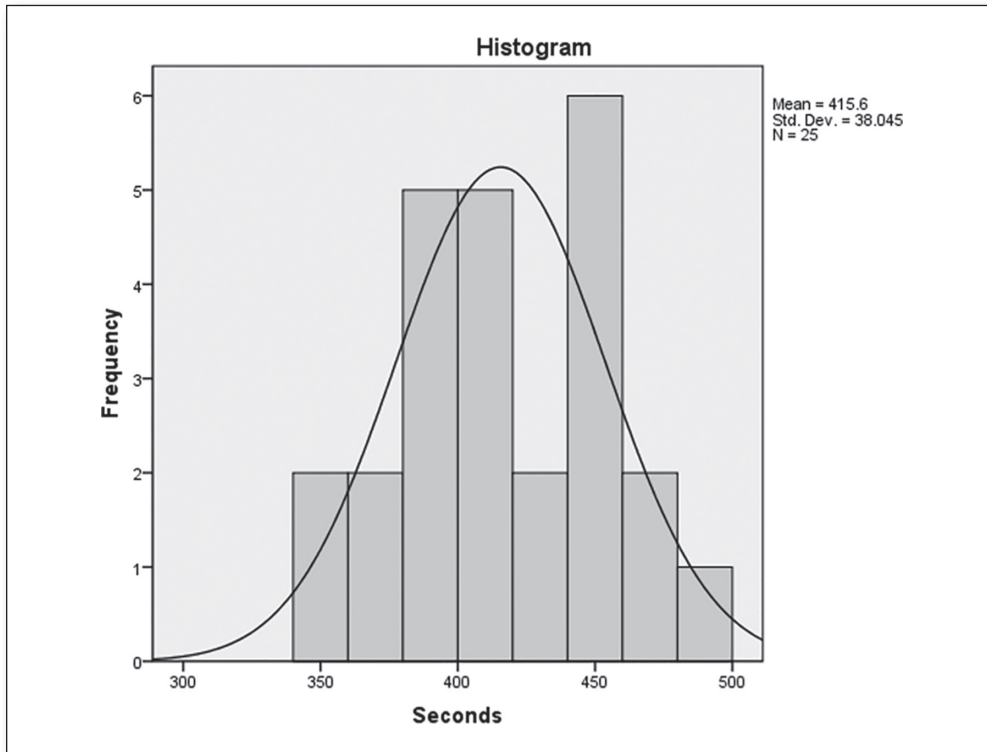
(b)

Histograms with normal curve plots show a normal distribution of *Seconds* for both groups as shown in the two figures below, hence, the pretest criterion of *normality* is satisfied.

Normal distribution for *Seconds* in Group 1 (Room lighting)



Normal distribution for *seconds* in Group 2 (Acme reading lamp)



Test of Homogeneity of Variances

seconds

Levene Statistic	df1	df2	Sig.
.785	1	48	.380

The homogeneity of variance score for *seconds* shows a significance (p) of .380; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups, hence, this pretest criterion passes.

The n for each group is 25 (see *Descriptives* table below), which is close to the minimal quota of 30 per group. The findings of the t test would be more robust if the n s were slightly higher.

(c)

The t test revealed the following:

Descriptives								
seconds								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Room lighting	25	416.44	33.904	6.781	402.44	430.44	331	489
Acme lamp	25	415.60	38.045	7.609	399.90	431.30	344	481
Total	50	416.02	35.667	5.044	405.88	426.16	331	489

ANOVA					
seconds					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.820	1	8.820	.007	.935
Within Groups	62326.160	48	1298.462		
Total	62334.980	49			

The mean reading time for Group 1 (Room lighting) is 416.44 seconds, whereas the mean reading time for Group 2 (Acme reading lamp) is 415.60 seconds. This .84-second difference is statistically insignificant since the significance (p) is .935 (which is greater than the .05 α level).

(d)

This study analyzed the effects that the Acme reading lamp had on reading speed. The 50 subjects were randomly assigned to one of two groups; half read a 1,000 word essay using regular room lighting, and the other half read the same essay using the new Acme reading lamp. Results revealed that, on average, those who read using the Acme reading lamp completed the essay about 1 second (.86 seconds) earlier than those who used regular room lighting read the essay (415.60 seconds vs. 416.44 seconds respectively). Using a .05 α level, the p value of .935 suggests that the Acme reading lamp does not facilitate significantly prompter reading speeds; hence, we do not reject H_0 . The claim that the Acme Company made, that this lamp increases reading speed, is not supported by these findings.