

Quiz Practice Questions 1 (Attendance 2) for Statistics 514
Design of Experiments
Chapter 18 Neter et al. and Kuhn

These are practice questions for the quiz. The quiz (not the practice questions) is worth 5% and marked out of 5 points. One or more questions is closely, but not necessarily exactly, related to one or more of these questions will appear on the quiz. These practice questions are *not* to be handed in. Quizzes are to be done *using Vista* on the Internet **before** 4am (West Lafayette time!) of the date of the quiz. Vista will *not* allow any quiz to be done late. It is *highly* recommended that you complete this practice quiz, by hand, *before* logging onto Vista. The quiz is an **individual** one which means that each student does this quiz by themselves without help from others.

Applied Linear Statistical Models (Neter et al.) Questions.

Chapter	Problem(s)	hints
18, pages 783–789	18.17	Winding Speeds
	18.18	Winding Speeds

(18.17) Winding Speeds: qz1-18-17-winding-residual,levене,box

(a) *Means and residuals*

The means are

$$\bar{Y}_{1.} = 3.5625, \quad \bar{Y}_{2.} = ?, \quad \bar{Y}_{3.} = 10.6875, \quad \bar{Y}_{4.} = ?,$$

The residuals are given on the SAS output.

(b) *Residual plot*

The residual plot indicates the variances are nonconstant for different winding speeds. In particular, the residuals are flared outward to the right. This residual pattern indicates a logarithm transformation may help to make the variances constant,

$$Y' = \ln Y$$

(c) *Levene test*¹

1. *Statement.*

H_0 : error variance constant over four speeds *versus*

H_1 : not constant for four speeds

2. *Test.*

From SAS, the p-value is (choose one) < **0.0001** / **0.01** / **0.10**

The level of significance is $\alpha = 0.05$

3. *Conclusion.*

Since the p-value is (choose one) **smaller** / **larger** than the level of significance we (choose one) **accept** / **reject** the null hypothesis that the error variance is constant.

(d) *Choosing transformation to make variance constant*

Consider the following table of various ratios of the variances and means,

winding speed	s_i^2/\bar{Y}	s_i^2/\bar{Y}^2	s_i^2/\bar{Y}^4
1	0.33567	0.09422	0.00742
2	?	0.11541	0.00334
3	0.98207	?	0.0008
4	1.7467	0.10546	0.00038

Which of the three statistics, s_i^2/\bar{Y} , s_i^2/\bar{Y}^2 , and s_i^2/\bar{Y}^4 is the most constant over the four winding speeds. What does this indicate?

¹The Neter text calculates test statistic relative to the *median*, whereas SAS calculates the test statistic relative to the *mean*. Consequently, the text and SAS will have (slightly) different results.

(e) *Box-cox*

From the SAS output, the various *SSE* values for given box-cox λ transformations, are given below.

λ	-0.2	-0.1	0	0.1	0.2
<i>SSE</i>	450.16	?	416.84	410.65	410.92

In this case, the best (minimum *SSE*) box-cox transformation of the data is given by

- (i) $\lambda = -0.2$
- (ii) $\lambda = -0.1$
- (iii) $\lambda = 0$
- (iv) $\lambda = 0.1$
- (v) $\lambda = 0.2$

although, as pointed out in the problem, the $Y' = \ln Y$ transformation, which corresponds to $\lambda = 0$, is also a good transformation as well.

(18.18) Winding Speeds: qz1-18-18-winding-transANOVA,residual,levne

(a) *Means and residuals*

The transformed means are

$$\bar{Y}'_{1.} = ?, \quad \bar{Y}'_{2.} = 0.7400, \quad \bar{Y}'_{3.} = ?, \quad \bar{Y}'_{4.} = 1.1943,$$

The residuals are given on the SAS output.

(b) *Residual plot and normal probability plot*

The residual plot is attached and it indicates the logarithm transformation worked, that the residual variances (choose one) **are** / **are not** constant over means.

The normal plot is attached and indicates normality since $r = ?$.

(c) *Levene test*

1. *Statement.*

H_0 : error variance constant over four speeds *versus*

H_1 : not constant for four speeds

2. *Test.*

From SAS, the p-value is (choose one) < **0.0001** / **0.9307** / **0.9332**

The level of significance is $\alpha = 0.05$

3. *Conclusion.*

Since the p-value is (choose one) **smaller** / **larger** than the level of significance we **accept** / **reject** the null hypothesis that the error variance is constant.