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Exercises Quantitative Methods

Worksheet: Levene Test

Exercise 4.1 (Berenson et al., page 489)

The following data represent the US-nationwide highest yield of different types of accounts (CD = certificate of deposit) in 2007:

Money Market	Six-Month CD	One Year CD	2.5-Year CD	Five-Year CD
5.21	5.50	5.41	5.35	5.35
5.19	5.44	5.40	5.25	5.30
5.20	5.40	5.40	5.20	5.25
5.16	5.40	5.40	5.20	5.25
5.12	5.39	5.39	5.15	5.22

At the 0.05 level of significance, is there evidence of a difference in the variation in yields among the Money-Market and the Six-Month CD accounts?

Exercise 4.2 (Berenson page 489)

An advertising agency has been hired by manufacturer of pens to develop an advertising campaign for the upcoming holiday season. To prepare for this project, the research director decides to initiate a study of the effect of advertising on product perception. An experiment is designed to compare five different advertisements *A, B, C, D, E*:

Advertisement	Pen's characteristics
<i>A</i>	greatly underselled
<i>B</i>	slightly underselled
<i>C</i>	slightly overselled
<i>D</i>	greatly overselled
<i>E</i>	correctly stated

A sample of six adult respondents for every of the five kind of advertisements was taken from a larger focus group. The 30 respondents are randomly assigned to the five kinds of advertisements, so that there are six respondents to each. After reading the advertisements and developing a sense of "product expectation", all respondents unknowingly receive the same pen to evaluate. The respondents are permitted to test the pen and the plausibility of the advertising copy. The respondents are then asked to rate the pen with points form 1=lowest to 7=highest on the product characteristic scales of

- appearance

- durability
- writing performance.

The sums of points of the three ratings for the 30 respondents are as follows:

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
15	16	8	5	12
18	17	7	6	19
17	21	10	13	18
19	16	15	11	12
19	19	14	9	17
20	17	14	10	14

At the 0.05 level of significance, is there evidence of a difference in the variation in ratings among two advertisements?

Solution of exercise 4.1:

1. Goodness of fit test Normal distribution of **Money Market**

$$S_{\text{SPSS}} = -1.064 \Rightarrow S = -0.714$$

$$K_{\text{SPSS}} = 0.202 \Rightarrow K = 2.051$$

No test recommendation

$$p\text{-value Lilliefors-Test} \geq 0.2$$

$$p\text{-value Shapiro-Wilk-Test} = 0.451$$

i.e. yield of Money Market has Normal distribution

2. Goodness of fit test Normal distribution of **Six-Month CD**

$$S_{\text{SPSS}} = 1.433 \Rightarrow S = 0.961$$

$$K_{\text{SPSS}} = 1.424 \Rightarrow K = 2.356$$

test recommendation

$$p\text{-value Shapiro-Wilk-Test} = 0.124$$

i.e. yield of Six-Month CD has Normal distribution

3. Test of Homogeneity of the variances

$$p\text{-value Levene-Test} = 0.632$$

There is no evidence of a significant difference in the variation of the yields.

Solution of exercise 4.2:

		Tests of Normality					
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Advertisement	Statistic	df	Sig.	Statistic	df	Sig.
Points	A	,212	6	,200*	,933	6	,607
	B	,299	6	,100	,851	6	,161
	C	,281	6	,152	,869	6	,223
	D	,172	6	,200*	,957	6	,798
	E	,206	6	,200*	,879	6	,264

* This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Pair	p -value Levene-test
A, B	0.710
A, C	0.019
A, D	0.234
A, E	0.044
B, C	0.032
B, D	0.341
B, E	0.076
C, D	0.418
C, E	0.576
D, E	0.676

There is evidence of a significant difference in the variation of the ratings among A, C and among A, E and among B, C .