SCHOOL OF PSYCHOLOGY UNIVERSITY OF SEVILLE
PSYCHOMETRICS (English group)
January, 2016
Partial 2, type A

Name: _____
Identification number: _____

Exercise 1. A test conformed by 4 items was applied to a sample of 5 participants. Calculate its reliability using the method of:

a. Guttman-Flanagan.

b. Rulon.

	IT 1	IT 2	IT 3	IT 4
1	1	1	1	1
2	0	0	0	1
3	1	0	1	1
4	1	0	1	0
5	1	1	0	1

Exercise 2. A sample of 200 scholars obtained in a test formed by 40 items a mean of 25, and a standard deviation of 2.5. The variance of the differences across even and odd items was 0.8. Calculate:

a. The reliability index.
b. The reliability coefficient supposing that we remove 20 items of the test.
c. The estimation of the true score (in raw scores) of a participant who scored 35 points in the test, using the regression method (C.L. 90%).

Exercise 3. The table below presents the results obtained in a multitrait-multimethod study where we calculated the correlation between introversion (I), aggressiveness (A) and sociability (S) using two different methods (A and B):

		Method A			Method B		
		I	A	S	I	A	S
Method A	I	0.96					
	A	0.29	0.95				
	S	0.36	0.4	0.93			
Method B	I	0.85	0.33	0.58	0.96		
	A	0.2	0.82	0.44	0.78	0.85	
	S	0.3	0.31	0.75	0.86	0.73	0.84

a. Mark over the table the reliability, convergent validity and discriminant coefficients.
b. Interpret the previous coefficients.

Exercise 4. We applied 40 items anxiety test. The correlation between this test and an external criterion is 0.7. We know that when the test is perfectly reliable, the final validity coefficient is 0.9.

a. How many items should be added to obtain a validity coefficient of 0.85?
b. Obtain the validity coefficient in the case that the anxiety test and the criterion are perfectly reliable, knowing that $r_{yy'} = 0.95$.

EXERCISE 1

	IT1	IT2	IT3	IT4	p	i	X	p^2	i^2	X^2	d	d^2
1	1	1	1	1	2	2	4	4	4	16	0	0
2	0	0	0	1	1	0	1	1	0	1	1	1
3	1	0	1	1	1	2	3	1	4	9	-1	1
4	1	0	1	0	0	2	2	0	4	4	-2	4
5	1	1	0	1	2	1	3	4	1	9	1	1
					6	7	13	10	13	39	-1	7

a) $r_{xx'} = 2\left(1 - \frac{S^2_p + S^2_i}{S^2_x}\right) = 2\left(1 - \frac{0'56 + 0'64}{1'04}\right) = 2\left(1 - \frac{1'21}{1'04}\right) = 2 \cdot (1 - 1'15) =$

$2 \cdot (-0'15) = -0'3$

$S^2_p = \frac{\Sigma p^2}{N} - \bar{p}^2 = \frac{10}{5} - 1'2^2 = 2 - 1'44 = 0'56$

$\bar{p} = \frac{\Sigma p}{N} = \frac{6}{5} = 1'2$

$S^2_i = \frac{\Sigma i^2}{N} - \bar{i}^2 = \frac{13}{5} - 1'4^2 = 2'6 - 1'96 = 0'64$

$\bar{i} = \frac{\Sigma i}{N} = \frac{7}{5} = 1'4$

$S^2_x = \frac{\Sigma X^2}{N} - \bar{X}^2 = \frac{34}{5} - 2'4^2 = 6'8 - 5'76 = 1'04$

$\bar{X} = \frac{\Sigma X}{N} = \frac{12}{5} = 2'4$

b) $r_{xx'} = 1 - \frac{S^2_d}{S^2_x} = 1 - \frac{1'36}{1'04} = 1 - 1'3 = -0'3$

$S^2_d = \frac{\Sigma d^2}{N} - \bar{d}^2 = \frac{7}{5} - (-0'2)^2 = 1'4 - 0'04 = 1'36$

$\bar{d} = \frac{\Sigma d}{N} = \frac{-1}{5} = -0'2$

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Exercise 2.

$N = 200$

$IE = 40$

$\bar{x} = 25$

$S_x = 2'5 \rightarrow S_x^2 = 6.25$

$S_d^2 = 0'8$

$FE = 20$

a) $r_{xx'} = 1 - \frac{S_d^2}{S_x^2} = 1 - \frac{0'8}{6'25} = 0'872$ $\quad (1 - 0'128)$

$r_{XT} = \sqrt{r_{xx'}} = \sqrt{0'872} = \boxed{0'93}$

b) $n = \frac{FE}{IE} = \frac{20}{40} = 0'5$

$R_{xx'} = \frac{n r_{xx'}}{1 + (n-1) \cdot r_{xx'}} = \frac{0'5 \cdot 0'872}{1 + (-0'5) \cdot 0'872} = \frac{0'436}{0'564}$

$\boxed{R_{xx'} = 0'77}$

$X = 35$

$C.L = 90\%$

$\downarrow$

$Z_c = 1'64$

c) $Lim = T' \pm E_{max}$

$T' = (35-25) \cdot 0'872 + 25 = 0'872\,(10) + 25 = 8'72 + 25 = 33'72$

$T' = r_{xx'}(x - \bar{x}) + \bar{x}$

$S_{TX} = S_x \sqrt{1 - r_{xx'}} \sqrt{r_{xx'}} = 2'5 \sqrt{1 - 0'872} \sqrt{0'872} =$

$2'5 \sqrt{0'128} \sqrt{0'872} = 2'5 \cdot 0'357 \cdot 0'933 = 0'83$

$S_{TX} = 2'83$

$E_{max} = Z_c \cdot S_{TX} = 1'64 \cdot 0'83 = 1.36$

$Lim = T' \pm E_{max} =$

$33'72 \pm 1.36 \quad \begin{cases} 35'08 \\ 32'36 \end{cases}$

EXERCISE 3

b)

- RELIABILITY coefficients are adequate (high)
- CONVERGENT VALIDITY coefficients are adequate (high)
- DISCRIMINANT VALIDITY coefficients are adequate in method A (low, lower than convergent validity coefficients). Nevertheless, they are not appropiate in method B (too high, in occasions even higher than convergent validity coefficients).

EXERCISE 4

IE = 40

$r_{xy} = 0.7$

$R_{TxY} = 0.9$

$R_{xy} = 0.85$

a) $R_{TxY} = \frac{r_{xy}}{\sqrt{r_{xx'}}} \rightarrow 0.9 = \frac{0.7}{\sqrt{r_{xx'}}} \rightarrow 0.9\sqrt{r_{xx'}} = 0.7 \rightarrow$

$\rightarrow \sqrt{r_{xx'}} = \frac{0.7}{0.9} = 0.78$

$r_{xx'} = 0.78^2 = 0.61$

$$n = \frac{R^2_{xy}(1 - r_{xx'})}{r^2_{xy} - R^2_{xy} r_{xx'}} = \frac{0.85^2 (1 - 0.61)}{0.7^2 - 0.85^2 \cdot 0.61} = \frac{0,72 \cdot 0,39}{0.49 - 0,72 \cdot 0.61} = \frac{0.28}{0.05} = 5.6$$

0.44

$n = \frac{FE}{IE} \rightarrow 5.6 = \frac{FE}{40} \rightarrow 40 \cdot 5,6 = FE$

$FE = 224$

Added = FE − IE = 224 − 40 = **184 items**

b) $$R_{TxTy} = \frac{r_{xy}}{\sqrt{r_{xx'}}\sqrt{r_{yy'}}} = \frac{0.7}{\sqrt{0.61}\sqrt{0.95}} = \frac{0.7}{0,78 \cdot 0,97} = \frac{0.7}{0.76} = 0.92$$