

SCHOOL OF PSYCHOLOGY UNIVERSITY OF SEVILLE  
 PSYCHOMETRICS (English group)

January, 2016

Partial 2, type B

Name: \_\_\_\_\_

Identification number: \_\_\_\_\_

**Exercise 1.** We applied an intelligence test to a sample of 500 participants, the sum of the empirical scores was 2000 and the sum of the deviation scores square was 3000. Calculate:

- The variance of the empirical scores.
- The variance of the true scores knowing that the reliability index is 0.6.
- The standard error of measurement.
- The correlation between the empirical scores and the errors.
- The mean of the random errors based on the linear model by Spearman.
- The mean of the true scores.

**Exercise 2.** 500 students answered a personality test composed by 45 items. Their mean was 144 and the variance, 90.25. Knowing that the 86% of the variance of the empirical scores is due to the variance of the true scores, calculate:

- The reliability index and the reliability coefficient.
- The reliability coefficient supposing that we remove 10 items of the test.

- The confidence interval in which we can say that there is going to be the true score (in standardized scores) of a participant that obtained a raw score of 153.5 in the test (Confidence Level: 90%). Use the regression method.

**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			
Method B	I	0.36	0.4	0.93		
	A	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

- Mark over the table the reliability, convergent validity and discriminant coefficients.
- 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.

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

EXERCISE 1

$N = 500$

$\sum X = 2000$

$\sum (X - \bar{X})^2 = 3000$

$r_{XU} = 0.6 \rightarrow r_{XX'} = 0.6^2 = 0.36$

a)  $S_x^2 = \frac{\sum (X - \bar{X})^2}{N} = \frac{3000}{500} = 6$

b)  $r_{XX'} = \frac{S_v^2}{S_x^2} \rightarrow 0.36 = \frac{S_v^2}{6} \rightarrow 0.36 \cdot 6 = S_v^2$

$S_v^2 = 2.16$

c)  $S_e = S_x \sqrt{1 - r_{XX'}} = 2.45 \sqrt{1 - 0.36} = 2.45 \cdot \sqrt{0.64} = 2.45 \cdot 0.8 = 1.96$

$S_x = \sqrt{6} = 2.45$

Another way

$S_x^2 = S_v^2 + S_e^2 \rightarrow 6 = 2.16 + S_e^2 \rightarrow 6 - 2.16 = S_e^2 \rightarrow S_e^2 = 3.84$   
 $S_e = \sqrt{3.84} = 1.96$

d)  $r_{Xe} = \frac{S_e}{S_x} = \frac{1.96}{2.45} = 0.8$

e)  $\bar{e} = 0$  ( $\sum e = 0$ )

f)  $\bar{v} = \bar{X} = \frac{\sum X}{N} = \frac{2000}{500} = 4$

EXERCISE 2

$N = 500$

$IE = 45$

$\bar{X} = 144$

$S_x^2 = 90.25 \rightarrow S_x = \sqrt{90.25} = 9.5$

$\frac{S_v^2}{S_x^2} = 0.86 = r_{XX'}$

$FE = 35$   
 $X = 153.5$

a)  $r_{XX'} = 0.86$  — RELIABILITY COEFFICIENT

$r_{XT} = \sqrt{0.86} = 0.93$  — RELIABILITY INDEX

b)  $R_{XX'} = \frac{n \cdot r_{XX'}}{1 + (n-1) r_{XX'}} = \frac{0.78 \cdot 0.86}{1 + (0.78 - 1) \cdot 0.86} = \frac{0.67}{1 - 0.1912} = \frac{0.67}{0.81} = 0.83$

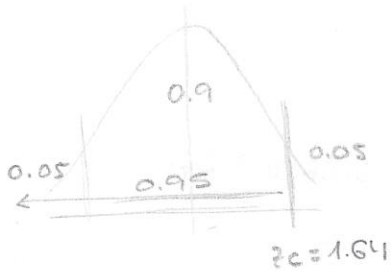
$n = \frac{FE}{IE} = \frac{35}{45} = 0.78$

c)  $Lim = z_T' \pm E_{max} = 0.93 \pm 0.56 < \begin{matrix} 1.49 \\ 0.37 \end{matrix}$

$z_T' = r_{TX} \cdot z_x = 0.93 \cdot 1 = 0.93$

$$z_x = \frac{x - \bar{x}}{s_x} = \frac{153.5 - 144}{9.5} = \frac{9.5}{9.5} = 1$$

$$G_{max} = z_c \cdot S_{z_{TzX}} = 1,64 \cdot 0,34 = 0,56$$



In z scores table, the value of z for any area of 0.95 (0.9495) is 1.64

$$S_{z_{TzX}} = \sqrt{1 - r_{XX'}} \sqrt{r_{XX'}} = \sqrt{1 - 0,86} \sqrt{0,86} = 0,37 \cdot 0,93 = 0,34$$

0,14

### 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 appropriate in method B (too high, in occasions even higher than convergent validity coefficients).

### EXERCISE 4

$$IE = 40$$

$$r_{xy} = 0.7$$

$$R_{xy} = 0.9$$

$$R_{xy} = 0.85$$

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

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

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

$$n = \frac{R_{xy}^2 (1 - r_{xx'})}{r_{xy}^2 - R_{xy}^2 r_{xx'}} = \frac{0.85^2 (1 - 0.61)}{0.7^2 - 0.85^2 \cdot 0.61} = \frac{0.72 \cdot 0.39}{0.49 - 0.72 \cdot 0.61} = \frac{0.28}{0.05} = 5.6$$

$$n = \frac{FE}{IE} \rightarrow 5.6 = \frac{FE}{40} \rightarrow 40 \cdot 5.6 = FE$$
$$FE = 224$$

$$\text{Added} = FE - IE = 224 - 40 = \boxed{184 \text{ items}}$$

$$b) R_{TxTy} = \frac{r_{xy}}{\sqrt{r_{xx'}} \sqrt{r_{yy'}}} = \frac{0.7}{\sqrt{0.61} \sqrt{0.95}} = \frac{0.7}{0.78 \cdot 0.97} = \frac{0.7}{0.76} = 0.92$$