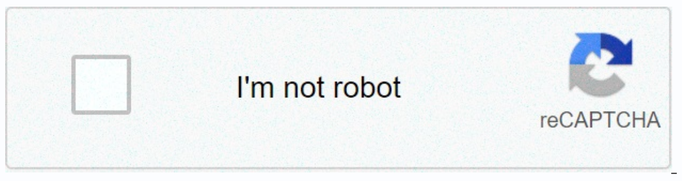

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How to calculate cronbach alpha by hand

Cronbach alpha alpha is a measure of internal consistency, that is, how closely a set of items as a group is related. This is considered a measure of scale reliability. A high value for alpha does not mean that the rate is unidimensional. In addition to measuring internal consistency, if you want to demonstrate that a given scale is non-Imidi, further analysis can be performed. Exploratory factor analysis is one of the methods of controlling dimensionality. Technically, Cronbach alpha is not a statistical test – it is a coefficient of reliability (or consistency). Cronbach alpha can be written as a function of the number of test items and the average correlation between items. Below for conceptual purposes, we display the formula for Cronbach alpha: $$ \alpha = \frac{N{bar{c}}{v}{v} + (N-1) \bar{c}}$$ Here N equals the number of items, $\bar{c}$ is the average covariance between items and $\{bar v}$ equals the average deviation. From this formula, you can see that if you increase the number of items, you will increase Cronbach's alpha. Additionally, if there is a low average correlation between items, alpha will be low. As the average correlation between items increases, cronbach alpha (holding the number of items constant) also increases. Example Let's consider an example

of how to calculate Cronbach's alpha using SPSS and how to check the dimensionality of the scale using factor analysis. In this example, we use a dataset that contains four test items — q1, q2, q3, and q4. You can download the dataset by clicking . To calculate cronbach alpha for all four items — q1, q2, q3, q4 — use the reliability command: RELIABILITY /VARIABLE =q1 q2 q3 q4. Here is the resulting output from the above syntax: The alpha coefficient for four items is .839, indicating that the items have a relatively high internal consistency. (Note that a confidence factor of 0.70 or higher is considered acceptable in most social science research situations.) Manual calculation of Cronbach's Alpha For demonstration purposes, here is how to calculate the above results manually. In SPSS, you can get covariance by going to analyze - Correlate - Bivariate. Then slide q1, q2, q3, and q4 into the Variables box, and then click Options. Under Statistics, check intermediate and covariance deviations. To get output, click Continue and OK. Below you will see a shortened version of the output. Note that diagonals (in bold) are deviations, and off-diagonals are covariances. We just need to consider the covariance on the lower left triangle, because it is a symmetrical matrix. q1 q2 q3 q4 q1 Covariance 1,168 .557 .574 .673 q2 Covariance .557 1,012 .690 .720 q3 Covariance .574 .690 1,169 q4 Covariance .673 .720 .724 1.291 Remember that $N=4$ equals the number of items, $\bar{c}$ is the average covariance between items, and $\bar{v}$ equals the average deviation. Based on the information from the table above, each of these components can be calculated as follows: $$\bar{v} = (1,168 + 1,012 + 1,169 + 1,291)/4 = 4.64 / 4 = 4 = 1.291 $1.16.16,$ $$\bar{c} = (0.557 + 0.574 + 0.690 + 0.673 + 0.720 + 0.724)/26 = 3,938 / 6 = 0.656,$$ $$ $$ \alpha = \frac{4 (0.656)}{(1.16) + (0.656)}{{(1.16) 16) + (4-1) (.656)}=2.624/3.128=0.839.$$ Results match our SPSS obtained by Cronbach Alpha 0.839. Dimensionality control In addition to calculating the alpha coefficient of reliability, we may also want to examine the dimensionality of the scale. We can use the command factor to do this: FACTOR / VARIABLE Q1 q2 q3 q4 / FORMAT SORT BLANK(.35). Here is the resulting output from the above syntax: When looking at a table named Total Variance Explained, we see that the eigen value for the first factor is slightly greater than the eigen value for the next factor (2.7 versus 0.54). In addition, the first factor represents 67 % of the total deviation. This indicates that the scaling items are unidimensional. For more information, the formula for Cronbach's alpha is: $$ \alpha =\frac{K}{K-1} (1-\frac{\sum_{i=1}^{K}\sigma^2_{Y_i}{sigma^2_X}) $$ Here's K the number of different items you've managed for each subject. Sometimes items are different questionnaire entries designed to measure the same basic structure. In your case, it sounds as if each item is a separate run of the experiment. To calculate Cronbach's alpha, you need to put the data in a wide format (as Michelle mentioned). This means that each of the 200 measurements must have its own column/variable. So your columns would subjectID, Answer1, Answer2, ... , Answer 200. I'm not sure where your expected response column will come from. Cronbach alpha is used to test the consistency of responses to each other, not to any actual value, because the actual measured value is latent (i.e. unknown). I suppose you could calculate a correlation between the average response and the expected response to see how well people performed. Or calculate the times they answered exactly as you expected and call them their score. As already suggested in the comments, it does not seem to make sense to calculate alpha on raw score. If they only make sense in relation to the expected response (i.e. as an indication of how well the subject is doing in this particular test), you must use an adjusted score that actually quantifies how well the subject has done. If answer 50 with an expected response of 25 does not mean the same as answer 50 with an expected response of 45, then calculating alpha on raw score is meaningless. To calculate Cronbach's alpha using R, read the CSV file into the data frame, reformat the wide format, then run cronbach.alpha only in the answer columns (assuming that your columns for subject and values are called SubjectID and Score): x.long <- read.csv(file=myfile.csv) library(reshape2) x.wide <- dcast(x.long, SubjectID ~ Score) library(ltm) cronbach.alpha(x.wide[,-1]) # remove SubjectID in the first column of Cronbach alpha alpha is the most commonly used statistic to determine the internal consistency of measurements, such as items in a questionnaire, test, or survey. This is equivalent to implementing a methodology of dividing half into all combinations of these items. Topics: Topics:

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