Converting Interview or Assessment Exercise Scores to a Civil Service Scale

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Overview: Government H.R. Departments need to be able to convert scores on interviews, in-baskets or other assessment exercises to a civil service type of scale which defines 70 as passing, with 100 being the best possible score. This paper provides a succinct explanation of the issues and demonstrates how to perform these conversions, which have traditionally been referred to as "transmutations" or "linear score conversions." The procedures described herein will work for converting scores from any type of test on any scale to a civil service scale.

There are other types of more technically oriented score conversions that government H.R. Departments typically do not use, but which are important to understand. "Standard scores" are used to convert scores to a scale that has a specific mean and standard deviation. A brief explanation of standard scores is also contained in this paper.

Converting Raw Scores to Civil Service Scores: Standard civil service scores are reported on a scale with 100 as the maximum score and 70 as passing. Frequently, however, oral interviews, training and experience evaluations, assessment centers, and other tests are scored on scales which have somewhere between 5 and 9 points. The issue is how to take the scores obtained on these kinds of tests and convert them to a total test score on a 1 - 100 point basis with 70 as passing.

Example #1: Six interview factors scored on a 9 point scale, with a score of 5 on each being considered passing.

For purposes of illustration, let's assume that you have an oral interview process in which there are six (6) factors, each rated on a nine (9) point scale, with the total score being the sum of the scores obtained on each of the six factors. This would mean that the best possible score would be 54 (6 factors x 9 points possible on each factor = 54 total points possible).

In order to take candidate scores and convert them to a standard civil service scale, you must begin by making an important decision: **What score will be considered passing?**

There is no easy answer to this question. You may wish to obtain the input of SMEs, or you may wish to make an informed judgment if you are the H.R. analyst, but realize that this is a key decision. Generally speaking, the safest approach is to set the passing mark at the level which represents the minimally acceptable level of knowledge or skill needed to perform the job. This, of course, is a theoretical proposition and not easily quantified. You also need to be aware of issues pertaining to adverse impact that arise under the federal Uniform Guidelines on Employee Selection Procedures (1978).

Since H.R. analysts are routinely involved in setting passing points, and since an examination of the issues involved in setting passing points is not the purpose of this brief paper, let's assume a passing score of 5 on the 9 point scale is chosen. Once this decision is made, we may proceed to convert the scores obtained by candidates to a civil service scale. As stated above, we have determined that 54 is the best possible interview score. If you choose the midpoint (5) as passing, then 6 factors x 5 = 30, which is the total needed to pass.

At this point, you need a linear conversion formula to transmute 54 raw points to 100 on the civil service scale and 30 raw points to 70 (passing) on the civil service scale. The standard form of a linear equation is used: $Y = mx + b$.

We prefer to write it as follows:

> Converted Score = (Multiplication Factor x Raw Score) + Constant. In abbreviated form, this would be: $CS = mx + c$; with **m** being a multiplication factor, **x** being raw scores on the interview, and **c** being a constant.

Note that on a 70 - 100 point civil service scale, the spread from passing to the best possible score is 30 points (100-70). In the example above with a raw point passing score of 30 and the best possible raw score of 54, the spread is only 24 points. Thus, you need to stretch this 24 point spread to a 30 point spread.

To do this, you must determine what is typically called the "multiplication factor." It is calculated by putting the 30 point civil service scale spread in the numerator, and dividing by the raw point spread between the best possible score and the passing score on the interview. In the present case, this spread is 24 points. Thus, the ratio needed to determine the multiplication factor is:

30 point spread on civil service scale/24 point spread on interview = **1.25**

You ALWAYS put the number 30 in the numerator, and ALWAYS divide by the point spread from passing to best possible on your interview (or other similar test).

Remember, the formula to convert scores is $CS = mx + c$. So far, we have calculated "m" and found it to be 1.25. Thus, our formula at this intermediate point is $CS = 1.25x + c$. We must now solve for "c," which is referred to as the **constant**. We solve for "c" by determining its value when the converted score (CS) is 70.

To do this, we substitute into the formula the raw score total that we have consciously set as the passing score (remember, we are using a score of 5 on each of the 6 factors, for a total required passing score of 30), then solve the formula for "c," as follows:

$$70 = 1.25\,(30) + c$$
$$70 = 37.50 + c$$
$$c = 32.50$$

Thus, our linear conversion formula can now be written as:

$$CS = 1.25x + 32.50$$

Thus, we now know that **m** is 1.25 and **c** is 32.50. Converting scores to the civil service scale is simply a matter of substituting them into the formula (each score being **x** in the formula).

To check the formula, you should substitute in the raw point interview total that you want to be "passing" to ensure that it converts to a score of 70; and you should also substitute in the best possible interview total score to ensure that it converts to a score of 100.

Thus, we verify the formula as follows:

1.25 (30) + 32.50 = 70. Checks! We see that a raw score of 30 converts to 70.

1.25 (54) + 32.50 = 100. Checks! We see that a raw score of 54 converts to 100.

Example #2: Six interview factors scored on a 9 point scale, with a score of 4 on each being considered passing.

If you set passing as 4 on the 9 point scale, then the total raw points needed to pass would be 6 factors x 4 on each = 24. Since the best possible score is 54, you already have a 30 point spread (54-24=30), and you won't need to multiply raw scores by anything (remember, the role of the multiplication factor is to achieve a 30 point spread on your interview scores, commensurate with the 30 point spread on the standard civil service scale from passing to the best possible score, i.e., from 70 to 100). You can verify this, however, by forming the ratio as done in the earlier example:

30 point spread on civil service scale/30 point spread on interview = **1.00**

In effect, your multiplication factor is 1.0, but convention has it that we don't write 1.0 in our formulas since it is redundant. Thus, at this point, we know that CS = m + c (it isn't incorrect to write this as CS = 1m + c, but it's just never written this way).

Since we have solved for **m**, we now proceed to solve for **c.** We do this by substituting in the interview point total needed to pass (24 points) as follows:

CS = 24 + c
c = 46

Thus, the conversion formula is:

CS = x + 46

To verify the formula, remember that we: (1) substitute in the raw point interview total that you want to be "passing" to ensure that it converts to a score of 70; and (2) substitute in the best possible interview total score to ensure that it converts to a score of 100.

We verify the formula as follows:

24 + 46 = 70. Checks! We see that a raw score of 24 converts to 70.

54 + 46 = 100. Checks! We see that a raw score of 54 converts to 100.

Example #3: Six interview factors scored on a 9 point scale, with a score of 3 on each being considered passing.

If you set passing as 3 on the 9 point scale, then the total points needed to pass is 6 factors x 3 = 18. The best possible score of 54 minus 18 leads to a spread of 36 points. In this case, you don't need to stretch the range, you need to shrink it. This is done by calculating the multiplication factor in the same manner as before:

30 point spread on civil service scale/36 point spread on interview = **.833**

To calculate the constant, substitute in your raw point passing total of 18, hence: .833 x 18 = 14.994. In order to raise this to a total of 70, you need a constant of 55.006. You may also see that this is the correct answer by solving the equation the same as in the prior examples (substitute in 70 as the CS and the raw point total needed to pass as "x"):

$$70 = .833\,(18) + c$$
$$70 = 14.994 + c$$
$$c = 55.006$$

Thus, the conversion formula is:

$$CS = .833\,X + 55.006$$

To verify the formula:

.833 (18) + 55.006 = 70.	Checks! We see that a raw score of 18 converts to 70.
.833 (54) + 55.006 = 100.	Checks! We see that a raw score of 54 converts to 100 (within rounding error).

Final Note: The methods explained here work regardless of the number of points on the original scale. Thus, it doesn't matter whether the scale has 9 points or 4 points. All that is required is to determine the best possible score, and the score you wish to set as the passing score. Given these two values, it is a straightforward matter to convert the best possible score to a civil service score of 100, and the passing score to a civil service score of 70.

Standard Scores: The reason for using standard scores is typically to ensure that predetermined weights of tests that comprise an examination are maintained, in a technical sense, when the scores on the tests are added. In brief, when adding scores on different tests, the true weight of each test is a function of the test's standard deviation. By converting scores on each test to standard scores, each test has the same standard deviation (and mean). Thus, if adding scores on two tests in standard score format, they will have an equal weight. This would not be true if the raw scores on the tests have different standard deviations.

There is no simple method to convert raw scores on an interview or any other test to standard scores. If you are going to do this with a hand held calculator, you really need to understand the principles very well. The best approach is to find software that will do the necessary calculations and produce the standard scores for you. We use the Statistical Package for the Social Sciences (SPSS), but there are programs in widespread usage that will do this just as well, such as SIGMA.

Without using mathematical notations, the process is as follows:

1. Calculate the mean and standard deviation of the scores obtained in your sample (e.g., if you interviewed 10 candidates, then calculate the mean and standard deviation of the total scores

obtained by the 10 candidates).

2. For each candidate, subtract the mean test score from the candidate's score.

3. Divide the result of step 2 by the standard deviation. When finished, you have a distribution in which the mean is zero, and the standard deviation is 1.0. These are known as Z Scores. You will have negative scores for those people who scored below the mean.

4. Many people don't like dealing with negative values and choose to transform the scores to what are referred to as T Scores. T Scores have a mean of 50 and a standard deviation of 10. To transform the Z Scores produced by step 3 into T Scores, multiply the Z Scores by 10. You now have a distribution with a mean of zero and a standard deviation of 10. Add 50 to all scores and you now have a distribution with a mean of 50 and a standard deviation of 10.

Note: If you wanted the mean to be 60, just add 60 to each person's score instead of 50. This might be preferable as long as it did not result in anyone scoring over 100. It is good to understand that multiplying scores changes the standard deviation, while adding a constant changes the mean.

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