So you have a bunch of raw scores, perhaps the class’ results on the midterm. How did you do compared to the rest of the class? How many people ended up with a score between 45-65? What score would you have gotten if you knew you ended up at the 70th percentile? How do you answer these questions about your distribution of scores?

In this document I use the words probability and percent when I am referring to the table in your book. Notice that the table in your book gives you values in terms of four decimals (.5432), so what I mean with probability and percent is the value in the table multiplied by 100 (.5432 \* 100 = 54.32). This is the probability or percent of the value in the table (54.32%). Notice that this is **not** the case for the column named ‘z’, this is simply a z-value, not a percentage or probability. Below this paragraph you will find the calculation and/or steps to get from one type of value to another. But before you do, here’s a quick guide on how to answer questions when using the values from the table in the book. When you specifically report the **percentile:** Ignore the decimals and write, for example for a table value of **.5432**: “If I had a z-score/raw score of #, I would end up in the **54th percentile**.”. However, when reporting a **specific probability**, you should include the decimal points: “The probability of having a raw score/z-score of #, is **54.32%**”. For the probability of a range, you also use the decimals “The probability of having a raw score/z-score between # and ##, is **54.32%**.”.

You have: You need: To get:

1. A raw score M, SD + formula Z-score

Here, you start out knowing a raw score, say your midterm score. You can use the formula (X – M)/SD, to calculate what the Z-score is for that raw score, based on the M and SD of the group.

1. Z-score Table + formula Percentile/Specific probability

If you need to know what the percentile (probability/chance) is for one ***specific*** raw score, you first need to find the z-score corresponding to that raw score (see 1. above). Then, with the z-score handy, look it up in the table in the book (under the column named z). Then look at a normally distributed curve, does the Z-score fall to the left of the mean (negative) or the right (positive)? If the Z-score is negative use the column ‘smaller portion’ to find the percentile. If the Z-score is positive, use the column ‘larger portion’ to find the percentile.

1. Z-score Table + formula Probability for a range

**If you are looking for the probability to get between two scores, firstly, we need only use the ‘mean to z’ column**. Secondly, depending on if the range includes/crosses the mean, we will either **add** two values (if the range includes the mean) or we will **subtract** two values (if the range does not include the mean):

**If the range crosses the mean,** for example, the mean is 50, and the range you are looking for is 40-52. Firstly, you need to find out how many percent “the first range” contains (40-50, which is the range starting at the mean, 50, to the cutoff, 40, = **below** the mean). Calculate the z-value of 40, find the z-value in the table and in the same row find the probability in the ‘mean to z’ column. This value tells you how many percent of the total number of scores that will fall within the range “mean to z” (in our case, that means between the raw scores 40-50). Secondly, we need to calculate the 50-52 range (= the range **above** the mean), so we need to find out what the probability is to end up in this “second range” (and lastly add the probabilities of the two ranges together to get the **full range**, which in this case is 40-52). Again, calculate the z-value of 52, go to the table in the book and look for the value in column ‘mean to z’. This value tells you how many percent of people end up with a score within the 50-52 range. Lastly, to know how high the probability is to end up in the full range, we have to **add** the probability of 40-50 to the probability of 50-52. **This final number is the probability to get a score between 40-52**.

**If the range does not cross the mean**, for example, the mean is 50, and the range you are looking for is 54-65. Firstly, find the value **furthest** from the mean, in this case, 65. (Notice here however, that if the range was below the mean, for example 34-46. The value furthest from the mean would be 34.) Calculate the z-value of 65, find the z-value in the table and in the same row find the probability in the ‘mean to z’ column. This value will tell you how many percent of the scores that fall within the range “mean to z” (in our case, that means between the raw scores 50-65). Immediately, you should notice that something needs to be done with this value! Originally we didn’t want the entire range from the mean to 65, we only wanted from 54 to 65! This is where subtraction comes in. So, right now, we have the probability of ending up in the range “mean to z” (50-65). However, we want to exclude (subtract) the probability for ending up in the 50-54 range, from the probability of ending up in the 50-65 range. That way, the end result is the probability for the 54-65 range. So, the next step is to calculate the z-value for the value **closest** to the mean, in this case, 54. Then find the z-value in the table and in the same row find the probability in the ‘mean to z’ column. This value will tell you how many percent of the total number of scores that will fall within the range “mean to z” (in this case, that means between the raw scores of 50-54). Finally, take the probability of the range **furthest** from the mean (this is the 50-65 range) **minus** the probability of the range **closest** to the mean (50-54), **this final value is the probability to get a score between 54-65**. (Notice here, that if the range was below the mean this calculation doesn’t change. For example for 34-46, we would take the probability of the range 34-50 (34 was the furthest value remember) minus the probability of the range 46-50 (the closest value). The end result is the probability to get a score between 34-46.)

1. Percentile Table Z-score

Usually, this will come in the form of a question like this: What is the z-score for someone in the 65th percentile? The first step here is to find the value closest to .65 in the table –but before that we need to know which column we should be looking in: The ‘smaller portion’ column or the ‘larger portion’ column. If the percentile falls **below** the mean (less than 50th percentile), we look in the ‘smaller portion’ column. If the percentile falls **above** the mean (more than 50th percentile), we look in the ‘larger portion’ column. For the 65th percentile, we look in the ‘larger portion’ column, and find the value closest to .65, now look in the z column on the same row to find the z-value corresponding to the percentile.

1. Z-score M, SD + formula Raw score

You might get a question like this: What raw score would you have gotten if you ended up on the 65th percentile? Alternatively: What raw score would you have gotten if you had a z-score of #. For the former question, start at 4. above to find the z-score. For the latter question, to get from a z-score to a raw score, use the formula (z \* SD + M). The end result is the raw score that someone would have at a certain percentile.