Grace Auld

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For a distribution to be considered normal, the shape of the distribution must be a bell shaped curve with the mean in the center as well as being the highest point. The curve would also be symmetrical about the mean. The two tails of the distribution will never touch the x-axis. The inflection points of the distribution that cup upward or downward occur at 𝜇 + 𝜎 and 𝜇 - 𝜎. The total area under the normal distribution curve equals 1. To have a normal probability distribution the mean would equal 0 and the standard deviation would equal 1. If adult male heights were normally distributed then that would mean 𝜇 would be centered under the curve.

A Z table contains values that are a number of standard deviations between the measurement and the mean. The z value or the z score gives the original measure *x* and *z = x -* 𝜇 / 𝜎. One would use the Z Table when one needs to find a Z score. The values inside the Z Table are probabilities, so they must lie between 0% and 100%. A strength of using the Z Table is that it is a standard table that works for any normal distribution once the values have been converted to the corresponding z-values. A weakness would be that the values given are more general than a value that a graphing calculator would give. Using the graphing calculator gives a more exact and precise value. The Z Table also can only be used for normal distributions.

According to the Empirical Rule, the normal distribution for adult males that we would expect would be 68% of the distribution would be between 67-73. We would expect 95% of the distribution to be between 64-76. Lastly, we would expect 99.7% of the distribution to be between 61-79. For the normal distribution of adult females, the mean and standard deviation are different. Therefore, we would expect 68% of the distribution to be between 61-67. We would expect 95% of the distribution to be between 58-70. Lastly, we would expect 99.7% of the normal distribution to be between 55-73.

To find the P(64<x<76) using the Empirical Rule, we would first need to draw the normal curve with the mean 70 in the center. We would then use the standard deviation, 3, and add it to 70 to get the value that is one standard deviation to the right of the mean. We would then continue adding 3 until we are three standard deviations from the 70. Next we would subtract 3 from the mean 70 in order to get the one value below the mean. We would keep subtracting 3 until we reached 3 standard deviations below the mean.After finding the three standard deviations to the right and left, we would find 64 and 76 on the graph and discover that it is approximately 95%. When using the z-table we must subtract 64 from 70 then divide by 3 in order to find the z value. The answer from this equation would be -2, then you find -2.00 on the z-table and the probability value is .0228. We do the same calculation for 76, the answer being positive 2. Positive 2 on the z-table converts to .9772. In order to get the probability that x is between these two values we must subtract, .9772 minus .0228 which equals .9544. To find the probability using the graphing calculator, first you go to 2nd VARS (DISTR) and then scroll down to 2)normalcdf(. The lower is 64, and the upper is 76. The mean is 70 and the standard deviation is 3. After inputting these values, hit enter. The answer is .9544. The answers from the z table and graphing calculator vary slightly because the calculator is more exact.

When finding the P(58<x<70) for female height using the empirical formula, we would create a normal distribution curve with the mean 64 in the center. To find the standard deviations to the left and right, you would add or subtract 3.  We would then find the values, 58 and 70 and find how many standard deviations these values are from the mean which is approximately 95%. When using the z-table, we would follow the same procedure as we did when finding the probability for males, but we would use the upper and lower values given for females. The z value that corresponds with 58 is -2 while the z value that corresponds with 70 is 2. These values then found in the z table are .9772 and .0228  In order to find the probability x is between these two numbers we would subtract .9772 and .0228 which equals .9544. To find the probability using the graphing calculator you would follow the same steps from the previous example, but using the mean and standard deviation for females.

We noticed the answers in E and F were the same. These values were the same because both methods of calculation resulted in the same z value. This is because of the z formula, z = x-𝜇 even though the mean is not the same for both males and females. This is important because even though the means and spread are both different, the probability can still be the same. The probability is not dependent on the mean or standard deviation.

When finding the P(61<x<73), we cannot use the empirical rule because when using the empirical rule the probability must be in the ranges of 68%, 95%, or 99.7%, when calculated, the probability is 84% which is not in any of the three ranges. The value must also be specific standard deviations from the mean which is not shown with this group due to the probability being 84%.  When using the z-table method, we that the z value that corresponds with 61 is .0013, and the corresponding z value for 73 is .8413. We found theses z values following the procedure that was stated in previous examples. Then subtract .8413 and .0013 to find the probability which equals .8400. To find the probability using the graphing calculator, you would once again use the normalcdf( function to input the given values. The answer that you would get is .8399. The z table answer and the calculator vary slightly because the calculator is more exact. We can’t use the Empirical Rule to find the probability P(55<x<67) for the same reasons we couldn’t when finding the probability for males. When using the z-table method, we would find the corresponding z value for 55, which is .0013 and the corresponding z value for 67, which is .8413. To find the probability between these two numbers we would subtract .8413 and .0013 which equals .8400. To find the probability using the graphing calculator we would once again use the normalcdf( function, as stated previously in other examples.

We noticed the values from H and I were the same even though they were for different normal distributions. These values were the same because when calculating the z values using the formula z = x-𝜇, the z’s were the same. This is important because it shows that even though the mean and spread of the data may be different, the probabilities can be the same.

The majority of our group prefers to use the graphing calculator. Preference for the graphing calculator stems from the fact that it is much quicker, and gives a more precise and exact answer. A benefit to the using the Z table over the calculator would be that you can see each step which gives you a better understanding of how to calculate a Z-Score. Having a better understanding of how to do the calculation by hand makes someone more competent in math, and having math competency is advantageous because the individual does not have to rely on technology.

To find the z-value that has 80% of the area under the standard normal curve to the left of it, we used the invNorm function on the graphing calculator. The steps for calculating using invNorm are: 2nd VARS (DISTR), then scroll to number 3 which is invNorm. The area in this case would be 80%, or .8, the mean would be 0, and the standard deviation would be 1. The z-value is 8.416. Then to find the adult male and female heights, you would do z(𝜎) + 𝜇. For the males, the calculation would be: .8416(3) + 70. This means the adult male height that corresponds to this Z is 72.5248. For females, the calculation would be: .8416(3) + 64. This means the adult female height that corresponds to this Z is 66.5248.

This paper discusses three different ways that we learned to calculate probability for a normal x distribution. This is useful because we are not limited to only one way of calculating probability of different situations. Overall we found that even if two examples have different means and standard deviations, there are still able to have the same probability. We concluded that it is more effective to use the calculator method due to the accuracy of the values.