PROJECT #4: Using Minitab Features – Erik Thompson

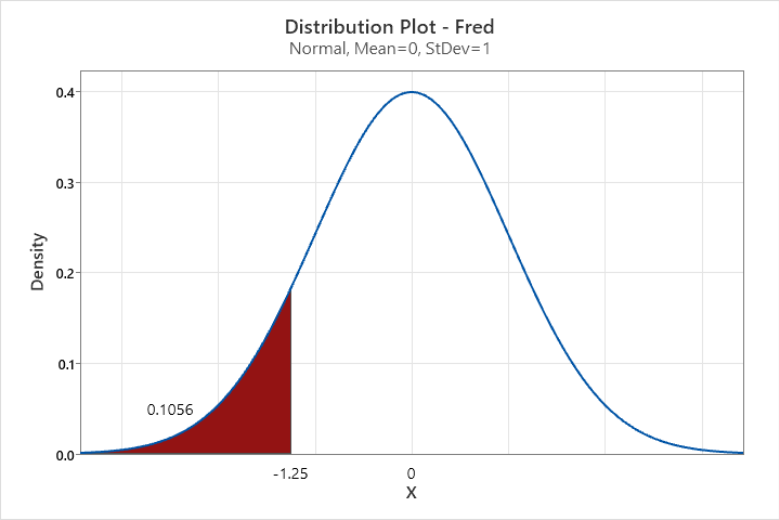
Proportion 'Less Than'

1] Suppose that sales employee evaluations at a company are reported in terms of z-scores for each employee so that they can see how they are performing compared to each other. Given the following three employees and their z-scores, generate distributional plots to show each employee where they fall on a standard normal distribution relative to their coworkers. Based on what you see, what kind of feedback might you provide each of the employees?

(1) Fred has a score of -1.25, **Fig 1.1**

Fred is more than 1 standard deviation below the average performance, the bottom 11%. It would be my recommendation that he attends a training class and seeks advice from some of the better performing employees to find out what has been working for them.

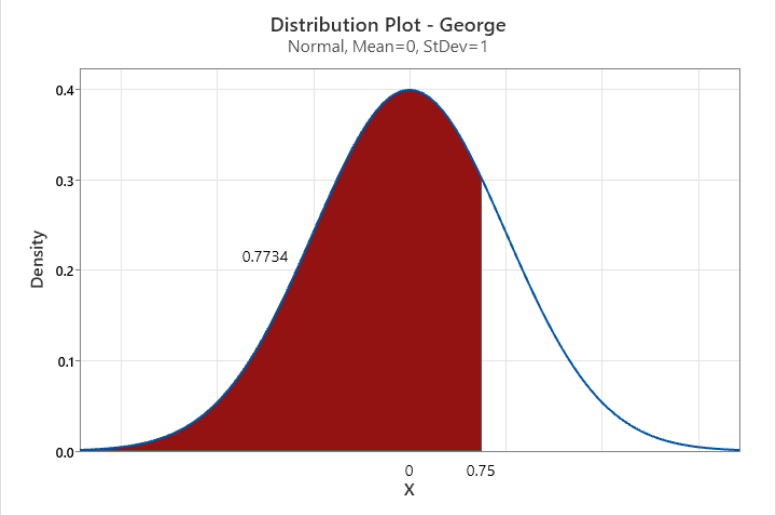
Fig 1.1 – Fred's Z score of -1.25



(2) George has a z-score of +0.75, **Fig 1.2**

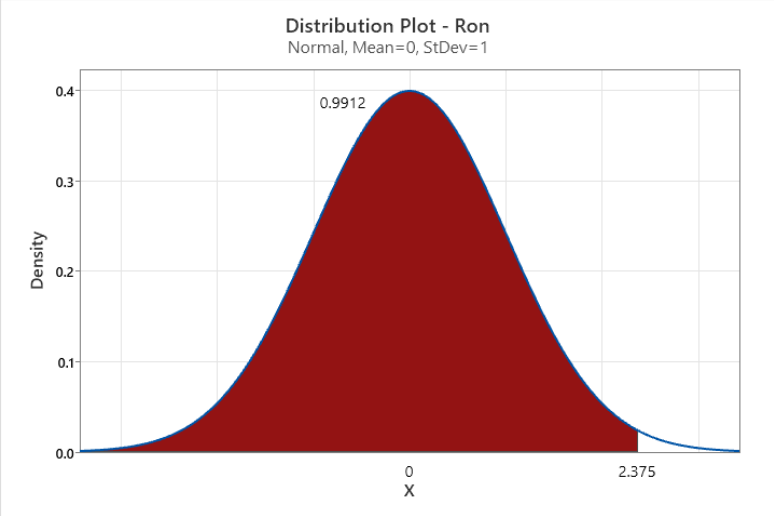
George is slightly above 1 standard deviation from having average performance at 27.34% above. If he wants to earn employee of the month someday, George should learn more about his weaknesses.

Fig 1.2 – George's Z score of +0.75



(3) Ron has a z-score of +2.37, **Fig 1.3**
Ron is in the top 1% percentile of performance at more than 2 standard deviations from the mean, and although he didn't have the highest scores on record, he should be proud of his efforts. Fred and George could get together with Ron and find out what he has been doing that works well.

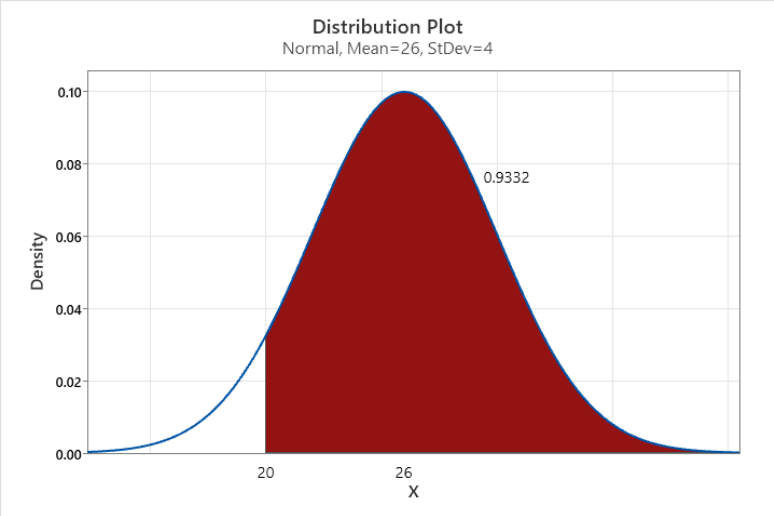
Fig 1.3 – Ron's Z score of +2.375



2] At a recent school board meeting it was suggested that too many people speed through a designated 20 mph school zone for the local middle school. Traffic data showed that the mean speed during school hours was actually 26 mph with a standard deviation of 4 mph. What is the probability that a randomly selected vehicle will be traveling faster than 20 mph in the school zone? What advice might you give to the school board?

There is a 93.32% chance that a randomly selected vehicle will be traveling above 20mph through the school zone, **Fig 1.4**. With such a high probability that any given vehicle will be speeding, it would be my recommendation to the school board to work with local law enforcement to set up speed zones.

Fig 1.4 – Probability of faster than 20mph



Proportion 'Greater Than'

1) A local business wants to design a reward system for its customers. If they assign bronze level status to customers above 1.5 standard deviations from the mean, silver level to customers above 2 standard deviations from the mean, and gold level to customers above 2.5 standard deviations from the mean, print out the distributional plots from Minitab for each of these three categories, and prepare a table to show to marketing how this reward promotion will work. In your table, make sure to show what percentage of customers will fall into each group: bronze, silver and gold.

The percentage of customers in each tier or above is shown in **figures 2.2** through **2.4**. The program will improve customer loyalty overall because of a visible reward system. It is recommended that low-cost rewards be allocated for the bronze tier, because bronze members will account for the largest section. Most of the programs' reward budget could be allocated to the gold rewards section, as shown in **Fig 2.1**, the smallest population of less than 1% of customers falling into this group. Silver rewards should be appealing to customers to incentivize progression through the program, however.

Reward Tier	Percentage by Tier
Bronze	6.7% Bronze tier or above
Silver	2.3% Silver tier or above
Gold	0.6% Gold Tier

Fig 2.1 – Probability by Tier, Bronze, Silver, and Gold Members

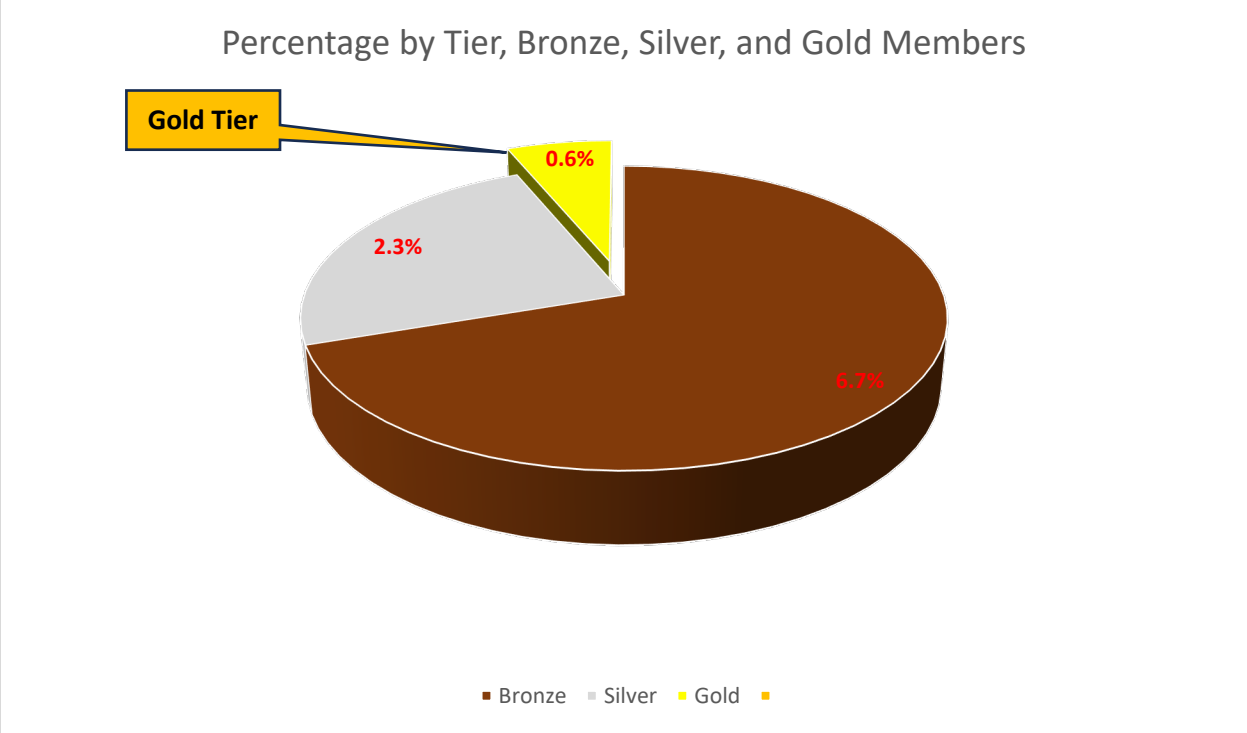


Fig 2.2 – Bronze Tier by Z score

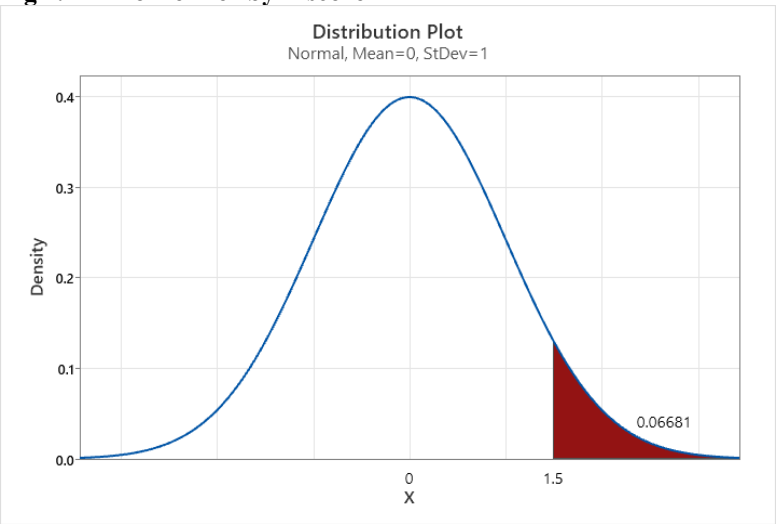


Fig 2.3 – Silver Tier by Z score

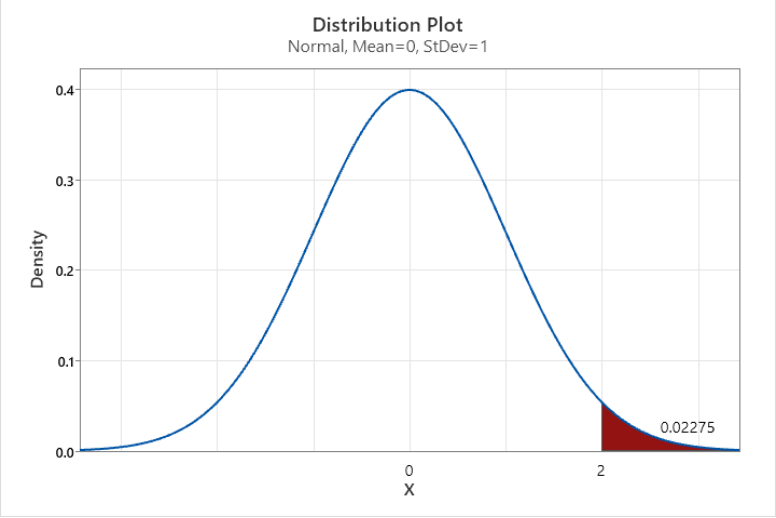
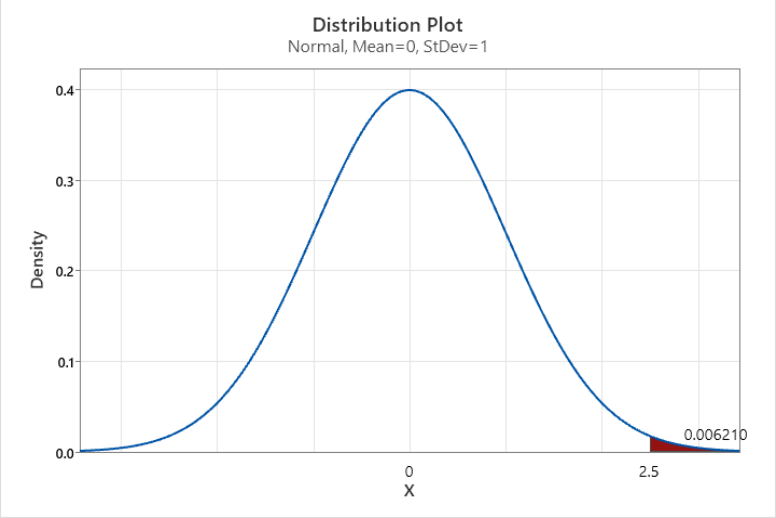


Fig 2.4 – Gold Tier by Z score



2) Now consider that the same company as above is considering designing a reward system based on total expenditures by its customers. If the average customer spends $2,000 per year with a standard deviation of $750, what percentage of customers spend more than $3,000? More than $3,500? More than $4,000? Print out the distributional plots from Minitab to support your table showing these levels of spending. You can assign a bronze level to $3,000, silver level to $3,500 and gold level to customers exceeding $4,000 per year.

According to **figures 2.5** through **2.7** 9.1% of customers will spend more than $3000 and be in the bronze tier, and 2.3% of customers spending more than $3,500 landing them in the silver tier, and 0.4% of customers in the gold tier. Based on these figures, the bronze tier based on spending would have 2.4% more customers than if it was based on Z score. The silver tier would be unchanged, and the gold tier would have slightly less members. If the program uses spending versus Z score, it will include more customers. The additional customers would be in a tier that is associated with a lower cost per capita. However, less customers will end up with premium rewards because there would be 0.2% less gold tier members.

Fig 2.5 – Percentage of customers spending above $3000

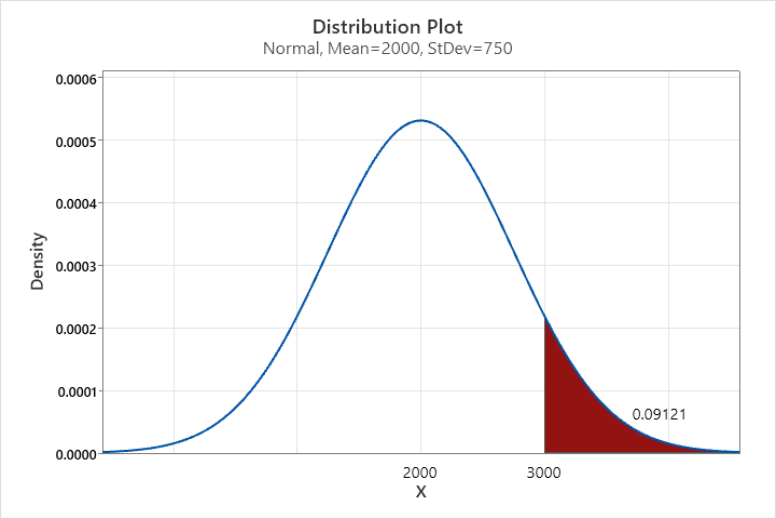


Fig 2.6 – Percentage of customers spending above $3500

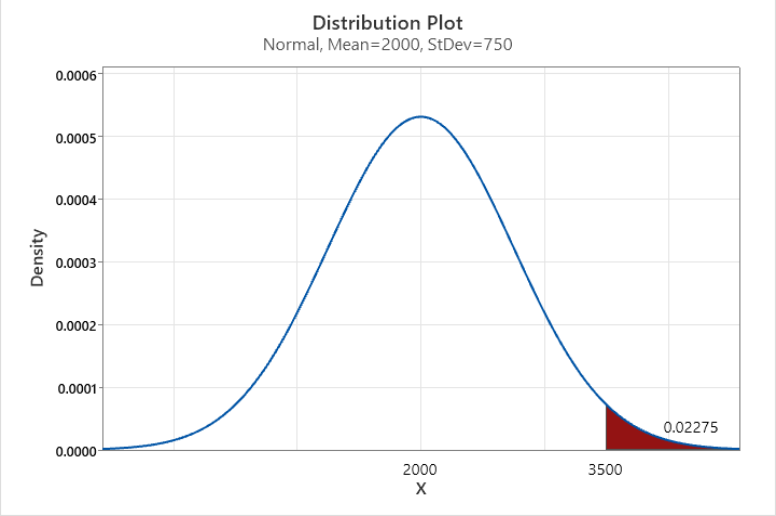
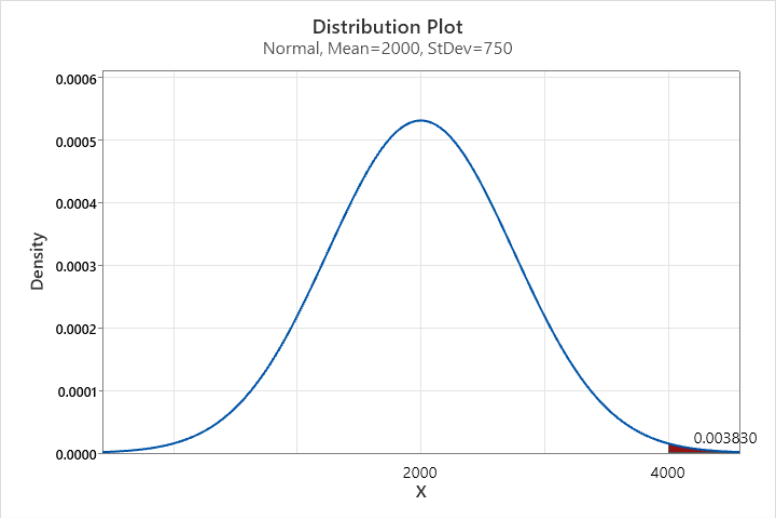


Fig 2.7 – Percentage of customers spending above $4000

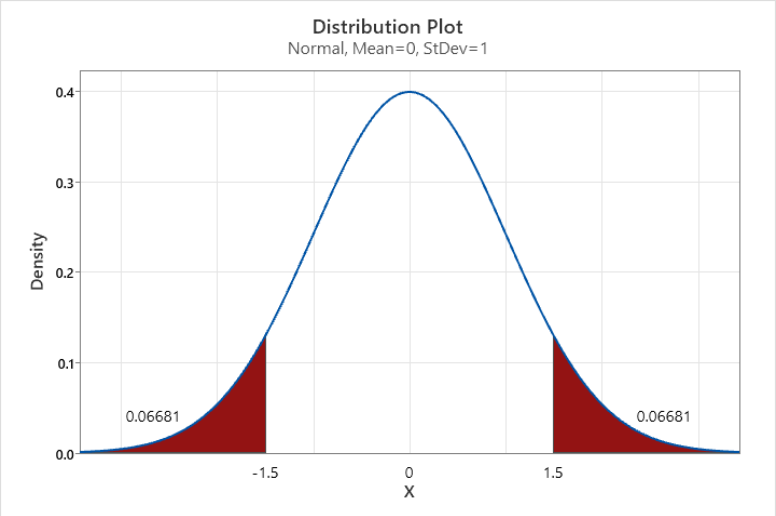


Proportion In between

1) A company that is manufacturing knitted scarves for sports fans in their team color will only sell final products that fall between 2.5 standard deviations of the mean (between -1.5 and +1.5 standard deviations). What percentage of manufactured scarves will be rejected and donated instead of being sold in stores? Use the distribution plot to support your written answer.

If the company rejects scarves that are below a Z score of -1.5 and above 1.5, then will reject 13.4% that will be donated. The remaining 86.6% will be sold in stores, according to **Fig 3.1**.

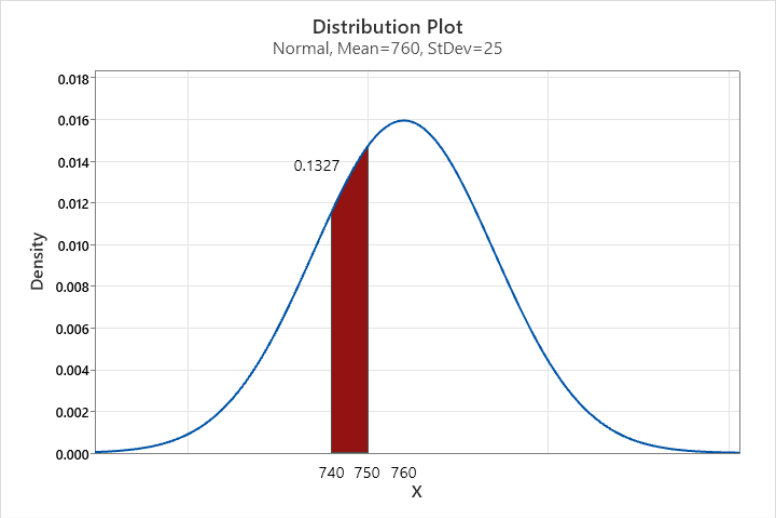
Fig 3.1 – Percentage of rejected scarves based on Z score



2) A local winery has a machine that fills its bottles with an average of 760 ml and a standard deviation of 25 ml of wine. If the bottle does not fill up to 740 ml, quality control rejects the bottle. However, bottles with more than 740 ml are within the acceptable tolerance and are permitted to be sold. What is the probability that a randomly selected bottle will contain between 740 and 750 ml, meaning that the customer is not getting the full 750 ml of wine that is advertised on the bottle's label? To what extent do you think the winery is cheating their customers? Discuss with the support of the distributional plot.

There is a 13.3% chance that a randomly selected bottle of wine will have less than the listed value of 750ml according to **Fig 3.2**. This means 13.3% of customers will get a bottle of wine with 98.7% of the listed volume. Considering that just as many bottles will be similarly above the listed volume, and the fact that 1.3% of the bottle is hardly a sip, customers on average are not likely to notice the variation.

Fig 3.2 – Probability of wine bottle containing 740ml to 750ml

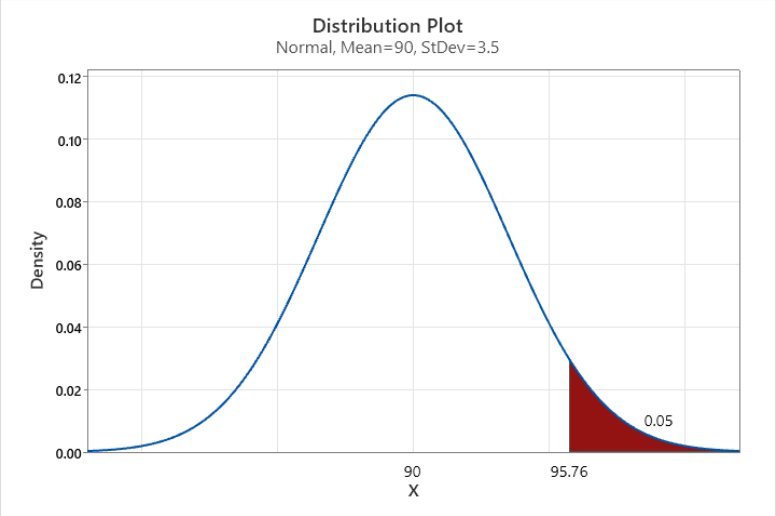


Finding Values Given Proportions

1) Suppose a baseball scout wants to invite pitchers whose fastballs are in the top 95% of pitch speeds to spring camp. If fastball pitch speeds are normally distributed with a mean of 90 mph and a standard deviation of 3.5 mph, what is the cutoff speed that a pitcher must pass in order to be invited to spring training? Show the distributional plot to support your answer.

A pitcher must have a pitching speed faster than 95.76mph to be invited to spring training according to Fig **4.1**.

Fig 4.1 – Fastball speed required to be invited to spring training.



2) Suppose that a cucumber farmer grows cucumbers that average 10 inches in length with a standard deviation of 3 inches. If he decides to set aside the smallest 7.5% of his output to be donated to the local food bank, what is the minimum size that a cucumber must be to be sold rather than donated? Provide a distributional plot and discuss.

A farmer will set aside all cucumbers that are below 5.7 inches in length to be donated according to **Fig 4.2**. Cucumbers above 5.7 inches in length will be sent to the market.

Fig 4.2 – Smallest 7.5% of Cucumbers to be donated