

1. An industrial sewing machine uses ball bearings that are targeted to have a diameter of 0.75 inch. The lower and upper specification limits under which the ball bearings can operate are 0.74 inch and 0.76 inch, respectively. Past experience has indicated that the actual diameter of the ball bearings is approximately normally with a mean of 0.753 inch and a standard deviation of 0.004 inch. What is the probability that a ball bearing is
 - (a) between the target and the actual mean?
 - (b) between the lower specification limit and the target?
 - (c) greater than the upper specification limit?
 - (d) 93% of diameters for ball bearings are greater than what value?

2. The fill amount in 2-liter soft drink bottles is approximately normally with mean of 2.0 liters and a standard deviation of 0.05 liter. If bottles contain less than 95% of the listed net content (1.90 liters, in this case), the manufacturer may be subject to penalty by the state office of consumer affairs. Bottles that have a net content greater than 2.10 liters may cause excess spillage upon opening. What proportion of the bottles will contain
 - (a) between 1.90 and 2.0 liters?
 - (b) less than 1.90 liters or more than 2.10 liters?
 - (c) At least how much soft drink is contained in 99% of the bottles?

3. The major stock market indexes had strong results in 2017. The mean one-year return for stocks in the S&P 500, a group of 500 very large companies, was +10.42%. The mean one-year return for the NASDAQ, a group of 3,200 small and medium-sized companies, was +28.74%. Historically, the one-year returns are approximately normally, and the standard deviation in the S&P 500 was approximately 20% and the standard deviation in the NASDAQ was approximately 30%.
 - (a) What is the probability that a stock in the S&P 500 gained value in 2017?
 - (b) What is the probability that a stock in the S&P 500 gained 10% or more in 2017?
 - (c) What is the probability that a stock in the S&P 500 lost 20% or more in 2017?
 - (d) What is the probability that a stock in the S&P 500 lost 30% or more in 2017?
 - (e) What is the probability that a stock in the NASDAQ gained value in 2017?
 - (f) What is the probability that a stock in the NASDAQ gained 10% or more in 2017?
 - (g) What is the probability that a stock in the NASDAQ lost 20% or more in 2017?
 - (h) What is the probability that a stock in the NASDAQ lost 30% or more in 2017?

4. The major stock market indexes had strong results in 2016. The mean one-year return for stocks in the S&P 500, a group of 500 very large companies, was +9.54%. The mean one-year return for the NASDAQ, a group of 3,200 small and medium-sized companies, was +7.50%. Historically, the one-year returns are approximately normal, and the standard deviation for the S&P 500 was approximately 20% and the standard deviation for the NASDAQ was approximately 30%.
 - (a) What is the probability that a stock in the S&P 500 lost value in 2016?
 - (b) What is the probability that a stock in the S&P 500 lost 10% or more in 2016?
 - (c) What is the probability that a stock in the S&P 500 gained 20% or more in 2016?
 - (d) What is the probability that a stock in the S&P 500 gained 30% or more in 2016?
 - (e) What is the probability that a stock in the NASDAQ lost value in 2016?
 - (f) What is the probability that a stock in the NASDAQ lost 10% or more in 2016?
 - (g) What is the probability that a stock in the NASDAQ gained 20% or more in 2016?
 - (h) What is the probability that a stock in the NASDAQ gained 30% or more in 2016?

5. According to an April 19, 2017 Business News article on Reuters.com*, the per capita consumption of soft drinks in the United States was 642 eight-ounce servings in 2016. If the per capita consumption of soft drinks in the United States in 2016 was approximately normally with a mean of 642 eight-ounce servings and a standard deviation of 100 eight-ounce servings,
 - (a) what is the probability that someone in the United States consumed more than 750 eight-ounce servings in 2016?
 - (b) what is the probability that someone in the United States consumed between 450 and 500 eight-ounce servings in 2016?
 - (c) up to how many eight-ounce servings did ninety-nine percent of the people in the United States consume in 2016?

* www.reuters.com/article/us-soda-sales-study/u-s-soda-sales-drops-for-12th-straight-year-trade-publication-idUSKBN17L2HN