Unit 7, Lesson 11

Estimating a Population Mean

Let's estimate population means, using sample data.

11.1 Rolling Distribution

In the next activity, you will roll a standard number cube 35 times.

1. Draw a dot plot that shows the distribution of values you might expect for the rolls. Explain your reasoning.

2. If you rolled the number cube 1 million times and found the mean of all the values, what would you expect for the mean? Explain your reasoning.

11.2 Rolling for Means

Roll your number cube 35 times, and record the values as you roll.

1. Every 5 values, find the mean.

rolls	1–5	6-10	11-15	16-20	21-25	26-30	31-35
mean							

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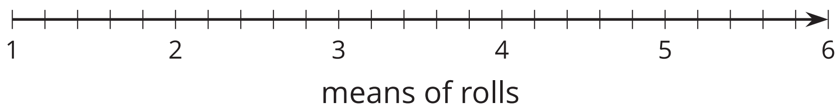
2. Share your means with your group, and create a dot plot of all the means from your group.



3. What do you notice about the shape of the distribution of means?
4. Using the dot plot of means, what do you think is a good estimate for the mean of all 140 rolls from your group? How does this value compare to your estimate from the *Warm-up*?

11.3 Margin of Error for Means

As with the means of sample proportions, when there is a large sample size or when the population distribution is approximately normal, the means of sample means are usually within 2 standard deviations of the sampling distribution of the means of the population mean. For each situation, use the sample data to estimate the mean for the population, and use the standard deviation from the sampling distribution to give a margin of error.

1. In 2010, a sample of 10 gas stations was selected at random, and the price of regular gasoline was recorded for each gas station. After many simulations, the sampling distribution has a standard deviation of $0.13.

   2.38 2.42 2.64 2.35 2.65 2.47 2.67 2.59 2.63 2.41

2. A sample of claimed UFO sightings in 13 randomly selected locations was recorded. After many simulations, the sampling distribution has a standard deviation of 158.1 sightings.

   400 427 892 640 713 614 725 477 460 445 476 336 536

3. A company producing baseballs selects 9 baseballs at random and measures the diameter in centimeters. After many simulations, the sampling distribution has a standard deviation of 0.22 centimeters.

7.5 7.6 7.2 7.4 7.2 7.3 7.5 6.9 7.5

4. A publisher takes a random sample of 15 people to determine the number of minutes they spend reading a newspaper. After many simulations, the sampling distribution has a standard deviation of 1.5 minutes.

   11.1 9.2 8.1 10.5 10 9.7 7.7 11.8

   11.1 7.6 6.3 9.4 10.4 8.7 10.2

Are you ready for more?

Place slips of paper numbered with the integers from 1 to 99 in a paper bag.

1. Draw a sample of 10, and record its mean.
2. What is the mean absolute deviation of the 10 numbers from their mean?
3. Use 50, the actual mean of all of the numbers in the bag, in the calculation of the mean absolute deviation of the 10 numbers you drew. How close is this value to the actual MAD of the sample?

Lesson 11 Summary

Similar to estimating proportions for populations, we can estimate a population mean based on a sample. First, find the mean of the sample to use as a point estimate for the population mean. Then, use the data to simulate collecting several more samples. The mean from each of the simulated samples creates a sampling distribution. We report the point estimate for the population with the margin of error, which is twice the standard deviation of the sampling distribution.

For example, a digital-clock maker wants to know how well their clocks keep time. They select a random sample of 40 clocks and compare them to an atomic clock to see how many seconds are lost or gained in a day. From the sample, they calculate the mean of the number of seconds lost or gained.

The mean of the sample is 0.095 seconds (0.095 seconds ahead of the atomic clock time). After running many simulations to create a sampling distribution of mean, the clockmakers find that the standard deviation of the sampling distribution is 2.791 seconds. The clockmaker should expect that the mean difference between their clock's time and the actual time is somewhere between -5.487 seconds ($0.095 - 2 \cdot 2.791$) and 5.677 seconds ($0.095 + 2 \cdot 2.791$).