Distributions

Discussion:

A frequency graph of a population distribution is often a smooth curve (called a density curve.) It is a smoothed-out version of the graph of the distribution of the values in a sample.   For example, think of a sample of size 75 from a population of size 10,000.   Imagine what the histogram of each of those would look like. Can you see why we might want to think of the smoothed-out version for our population distribution?

Discussion:

Just as a histogram of a sample has 100% of the scores in the sample represented in the total area of the bars, so does the area under the smoothed curve of a population distribution has 100% of the scores in the population.   That total area may be expressed as 1.00 instead of 100%.

Activity 1.

Sketch a right-skewed density curve, a left-skewed density curve, and several symmetric density curves. There are MANY density curves!

Discussion :

What are some types of questions we ask about population distributions?
- What proportion / percentage of the scores are below 7?
- What proportion of the scores are between 3 and 13?
- What proportion of scores are above 14?
- What score has 35% of the scores above it?

What are some distributions for which we can actually answer these?
Answer: Uniform and Normal.   See pictures in Figure 3.4 and Figure 3.8.

Activity 2. Consider a uniform height distribution on the interval from 5 to 15.   Sketch a picture.

1. Since the area of the rectangle must be 1 (because this is a density curve,) what would be the height of the rectangle? (Then label the vertical axis)

2. What is the probability that an order takes 15 minutes or less to pack?

3. What is the probability that an order takes 12 minutes or more to pack?

4. What is the probability that an order takes between 9 and 13 minutes to pack?

5. What is the probability that an order takes less than 8 minutes or more than 11 minutes to pack?

6. What is the probability that an order takes more than 25 minutes to pack?

7. If the supervisor wants to study the 20% of orders taking the longest time to pack, he needs to study orders taking at least how long?

Discussion:

For symmetric distributions, where are each of the mean and the median?
For skewed distributions, where are the mean and the median?

Activity 3: Do exercise 3.4 at the end of the section "Describing density curves."

Discussion:
- There are many different normal distribution curves, with different centers and spreads, but the all have the same basic bell-shape.
- There is a difference in notation between the parameters in a population distribution (μ and σ, called "mu" for the mean and "sigma" for the standard deviation) and the statistics in the distribution of a sample ($\overline{X}$ for the mean and s for the standard deviation).
- In any normal distribution,
    o approximately 68% of the scores are within one standard deviation of the mean
    o approximately 95% of the scores are within two standard deviations of the mean
    o approximately 99.7% of the scores are within three standard deviations of the mean

Activity 4:
1. Sketch a normal distribution with mean 50 and standard deviation 3. Along the horizontal axis, label at least five values appropriately.

2. Use your picture and the 68-95-99.7 rule to say what percentage of the scores are between 44 and 56.

3. Use your picture and the 68-95-99.7 rule to say what percentage of the scores are between 47 and 53.

4. Use your picture and the 68-95-99.7 rule to say what percentage of the scores are above 53.

5. Use your picture and the 68-95-99.7 rule to say what percentage of the scores are between 50 and 56.

6. Use your picture and the 68-95-99.7 rule to say what score has 2.5% of the scores below it.

More examples of these: Blackboard > Course Documents > Chapter 3 > Chapter 3 activities

Discussion:
    Since all normal distributions have the same shape, we can compare values in different normal distributions by "putting them onto the same scale."   We do that by computing a z-score of each and comparing the z-scores.

Activity 5:   Do exercise 3.9 at the end of the Standard Normal Distribution section.

Discussion:
- How do we answer questions like those in Activity 4 if the scores of interest aren't exactly 1, 2, or 3 standard deviations from the mean?
     Answer: Use a table of areas in a normal distribution. Table A.

 NEXT CLASS:

- Examples which we will do in class next time.
     Blackboard > Course Documents > Chapter 3 > Normal calculations