A Normal Distribution Simulation

The goal of this activity is to understand the normal distribution through a simulation.

The mean and standard deviation of the gas mileage of a 1996 Honda Civic in normal driving conditions before an oil change is 34.45 and 2.60, respectively. After an oil change, the gas mileage of the car is 38.8 miles per gallon on the tank of gas. How likely is that result?

Simulation

The TI graphing calculator provides a built in function for generating random numbers from a normal distribution. It is located in the MATH key in the PRB menu. The syntax of the function is given below.

\[ \text{randNorm}(\mu, \sigma, n) \]

where \( \mu \) = mean of the population, \( \sigma \) = the standard deviation of the population and \( n \) = the number of random numbers to be generated.

1. To simulate this situation, generate 20 random numbers using the parameters above. (You might want to store the list of 20 numbers in L1 and then sort it.) Record these values to the nearest thousandths.

2. Because the likelihood that your simulation resulted in exactly 38.8 is remote, the question becomes: How likely is it that the 1996 Honda Civic will get at least 38.8 mpg?

3. Pool the results of each member of your group.

4. Interpret the results of your group.
Using a Table

We have already seen that Table A provides the true probability of a normal probability distribution. However, the values of table are only given for the standard normal distribution.

<table>
<thead>
<tr>
<th>Finding the Area under any Normal Curve</th>
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<tbody>
<tr>
<td>Let $X$ be a normal probability distribution with mean $\mu$ and standard deviation $\sigma$. Then the probability that $X$ is in the interval $(a, b)$ is given by</td>
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<tr>
<td>$P(a &lt; X &lt; b) = P(z_a &lt; Z &lt; z_b)$</td>
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<td>where $z_a$ and $z_b$ are the $z$-scores of $a$ and $b$, respectively.</td>
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</tbody>
</table>

5. Use Table A to find $P(X > 38.8)$.

6. Compare your answer in item 5 to the proportion you found in item 4.

Using Technology

Recall that the TI graphing calculator has a built-in function for determining the cumulative distribution function: `normalcdf(lower, upper, \mu, \sigma)`.

7. Use a calculator to find $P(X > 38.8)$.

8. How likely is that, after an oil change, the gas mileage of the car is 38.8 miles per gallon on the tank of gas?

9. Determine the 90th percentile gas mileage for the 1996 Honda Civic.