Project Connection

Permutations, Combinations, and Probability

By now, you should have completed most (if not all) of your research, and you should now be analyzing the data. One way to look at your data is to determine whether or not the skills associated with probability can be used to help in your analysis. You can use calculated probabilities to help support the point of your presentation.

Fingerprint Data

Rohan is interested in how fingerprints are used in criminal cases to convict a defendant. He decided that his presentation would be about why fingerprint testing is effective in placing someone at the scene of a crime.

Rohan researched his topic and discovered that Sir Francis Galton established, mathematically, that one can assume each person's fingerprints are unique. Rohan decided to use fingerprints from two different people to show that the probability of the fingerprints being the same is quite small.

Simulation
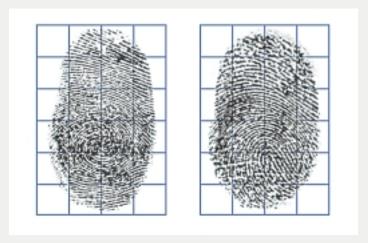
The process Rohan followed in his presentation is outlined below. It is similar to the steps first used by Galton in 1892.

Purpose

To use probability to show that two people's fingerprints are unlikely to be identical.

Procedure

A. Obtain two fingerprints. (Two fingerprints are shown below in case you are having difficulty obtaining others.)

B. Galton wanted to find the probability that two fingerprints are identical. To do so, he separated each fingerprint into 24 equal squares, as shown on the preceding page. He then defined three different events, as shown below.

W: The same number of lines (ridges) pass through two corresponding squares.

X: The lines (ridges) in two corresponding squares have the same general direction.

Y: Two corresponding squares match (both in number of lines and direction).

Estimate each of the following probabilities.

(i) $P(W)$ **(ii)** $P(X)$ **(iii)** $P(Y)$

C. Using your results in part B, what is the probability of two people's fingerprints being the same?

D. Answer each of the following.

- How does the probability in Step C show that the probability of two fingerprints being identical is very small?

- Is each event that Galton defined above an independent event? Why or why not?

Now take a look at the data that you have collected for your project.

- Should you be calculating any probabilities based on your data? If so, what are they?
- When you calculate the probabilities using your data, what do you think you will find? Is this to be expected? What does this mean for your data and your conclusions?
- Calculate any probabilities you need to find. Interpret each probability for your data. Does this help support any conclusions that you wish to make?