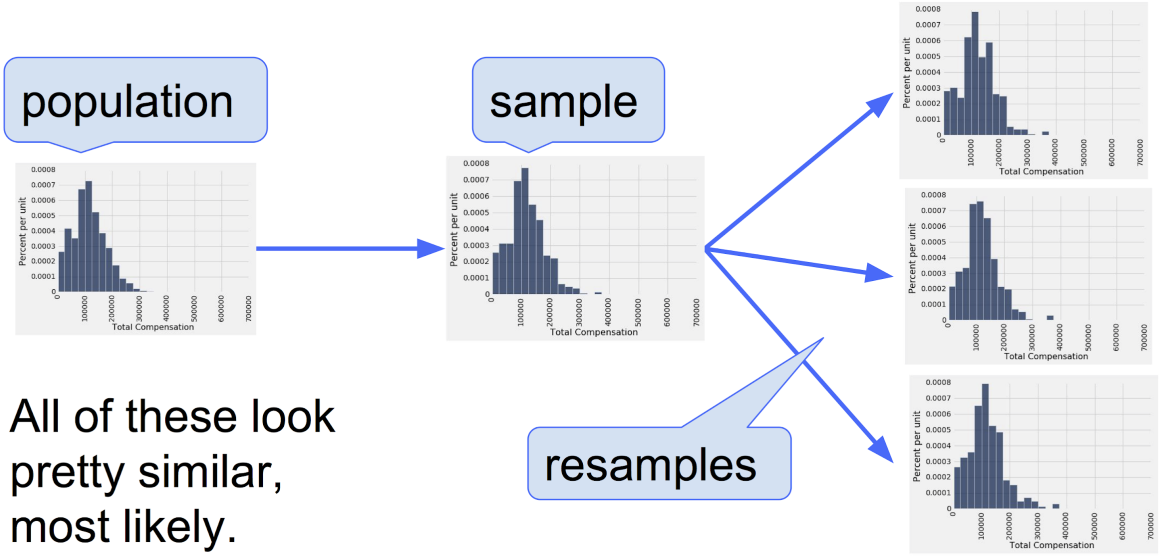
Lab 08: Bootstrap, Confidence Intervals

Data 8 Discussion Worksheet

Suppose we are trying to estimate a *population parameter*. Whenever we take a random sample and calculate a statistic to estimate the parameter, we know that the statistic could have come out differently if the sample had come out differently by random chance. We want to understand the *variability* of the statistic in order to better estimate the parameter. However, we don't have the resources to collect multiple random samples. In order to solve this problem, we use a technique called *bootstrapping*.



All of these look pretty similar, most likely.

1. **Warm-Up:** What is the difference between a parameter and a statistic? Which of the two is random?

2. Sampling Techniques: Assume we have one large, random sample. How could we generate another sample that resembles the population if we don't have the resources to sample again from the population?

3. Tennis Time: Ciara is interested in the heights of female tennis players. She's collected a sample of 100 heights of professional women's tennis players. She wants to use this sample to estimate the true interquartile range (IQR) of all heights of professional women's tennis players.

Hint: We defined the interquartile range (IQR) to be: **75th percentile - 25th percentile**

a. In order to construct a 99% confidence interval for the IQR, what should our upper and lower percentile endpoints be?

b. Define a function `ci_iqr` that constructs a 99% confidence interval for the IQR as follows. The function takes the following arguments:

   - `tbl`: A one-column table consisting of a random sample from the population; you can assume this sample is large
   - `reps`: The number of bootstrap repetitions

   Hint: To find the 25th and 75th percentile of an array, you can use the `percentile` *function*

```
def ci_iqr(tbl, reps):
     stats = __________________________________________
     for ___________________ :
          resample_col = __________________________________
          new_iqr = _______________________________________
          stats = _________________________________________
     left_end = __________________________________________
     right_end = _________________________________________

     return make_array(left_end, right_end)
```

c. Say Ciara recruited 500 of her friends to perform the same bootstrapping process she did. In other words, each of her friends drew a large, random sample of 100 heights from the population of professional women's tennis players and constructed their own 99% confidence intervals. Approximately how many of these CI's do we expect to contain the actual IQR for the heights of professional women's tennis athletes?