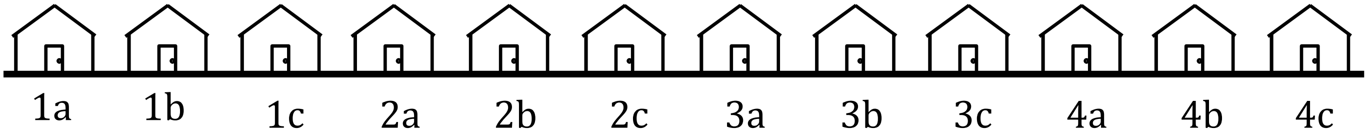
DS 100: Principles and Techniques of Data Science Date: January 25, 2019

Discussion #1

Name:

Probability & Sampling



1. Kalie wants to measure interest for a party on her street. She assigns numbers and letters to each house on her street as illustrated above. She picks a letter "a", "b", or "c" at random and then surveys every household on the street ending in that letter.
   (a) What kind of sample has Kalie collected?

   (b) What is the chance that two houses next door to each other are both in the sample?

   (c) Now suppose Kalie instead picks one house beginning with '1' at random, one house beginning with '2' at random, and so on, so she surveys four houses, one of each number. What kind of sample has Kalie collected?

   (d) Kalie randomly selects 4 houses without replacement on the street. In each house, she randomly selects one household member to interview. What kind of sample has Kalie collected?

2. There are 32 participants in a randomized clinical trial: 8 are male and 24 are female. 16 are assigned to treatment and the others are put into the control group. What is the probability that none of the men are in the treatment group if:
   (a) the treatment was assigned using stratified random sampling, grouping by gender?

   (b) the treatment was assigned using simple random sampling?

   (c) the treatment was assigned using cluster random sampling of 2 groups of 8 using clusters as described below?

Cluster	Male	Female
A	0	8
B	3	5
C	5	3
D	0	8

A Big Data Fail

Consider the 1936 federal presidential election of FDR vs. Al Landon. The magazine Literary Digest's straw poll had correctly predicted the outcome of the previous five presidential elections. Running up to the election, they polled over 10 million individuals including

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- magazine subscribers
- registered automobile owners
- telephone owners
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and received responses from about 2.4 million of those polled. The Literary Digest predicted Landon would win in a landslide. By contrast, George Gallup's quota sample consisted of bi-weekly surveys of $2,000$ individuals, and correctly predicted a landslide for FDR.

3. What are some potential sources of bias in each of these polling schemes?

Data-Driven Study Design: COMPAS Algorithm for Predicting Recidivism

Recidivism is the tendency of a convicted criminal to reoffend. The COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) algorithm, developed by the company Northpointe (now equivant), predicts recidivism risk based on variables related to criminal history, drug involvement, and juvenile delinquency. It is used by US courts for the purpose of case management, to predict a defendant's risk of committing more crimes.

4. We will examine the COMPAS algorithm and, in particular, a ProPublica study pointing to its racial bias (https://www.propublica.org/article/how-we-analyzed-the-compas-recidivism-algorithm). We will discuss general issues raised by the application of such algorithms, e.g., in terms of ethics, privacy, security, and governance? We will also walk through steps you might take to address questions related to the accuracy and potential racial bias of the COMPAS algorithm.

   The questions are meant be discussed with the people around you as a group and there is no right or wrong answer.

   (a) What is the population of interest for COMPAS?

   (b) What are some features or attributes that were used by COMPAS to design the algorithm? Are there features or attributes that you think should've been included or taken out?

   (c) How do you define "accuracy" and "racial bias"?

   (d) How should data be collected or obtained to assess the accuracy of predictors like COMPAS? Would you sample at random from the population of interest?

   (e) What are some ways we can assess the accuracy of COMPAS?

   (f) Think about the concepts of false positives and false negatives in this scenario. What are the ramifications or costs of a false positive and/or false negative?