Math 21 – Pointers for Section 1.5

- A sample has **bias** if the results of the sample are not representative of the population.
  There are 3 types of bias that we cover in this course: sampling bias, nonresponse bias, and response bias.
  In the real world, you should always be on the lookout for potential sources of bias.
  In this class, you should be able to identify these sources of bias in the homework – this is not a topic that will carry forward.
- **Sampling Bias**
  This occurs when the sampling technique used favors selecting certain parts of the population over the other. (Convenience sampling will almost always cause sampling bias.)
  A part of the population that is underrepresented in the sample causes sampling bias due to **undercoverage**.
  Example: If we do a phone survey of people with landlines, then people who only have a cell phone will be underrepresented in the sample. This is sampling bias.
- **Nonresponse Bias**
  This occurs when those who don't respond to a survey have significantly different opinions than those who do.
  Making a callback or offering financial incentives are ways to combat nonresponse bias. Guilt trips work really well, too.
  A famous example is the 1936 presidential election. A magazine sent out surveys to potential voters, but many of the voters who were OK with Roosevelt's performance were not motivated to return their surveys. So the results were skewed in a negative way about Roosevelt, who went on to win the election in a landslide.
- **Response Bias**
  This type of bias occurs when answers on a survey do not reflect the true feelings of the respondent.
  There are many causes of response bias, including …
  Interviewer Error (it's hard to get people to admit that they use illegal drugs, but a skilled interviewer can)
  Misrepresented Answers (some people will misremember or even lie when asked about their GPA, salary, weight, height, …)
  Wording of Questions (may lead the individual to one response over another – "Everyone thinks the government is spending too much money, don't you agree?")
  Order of Questions/Words (a survey should be presented in several different orders, and "approve or disapprove" should be rotated with "disapprove or approve")
  Type of Question (wording of open questions and closed questions must be considered)
  Data-entry Error (garbage in … garbage out, if a test score is entered as 19 instead of 91 the results will be skewed)

- **Nonsampling error** results from all of the above (undercoverage, nonresponse bias, response bias, data-entry error, …).

  Sampling error results from using a sample statistic to estimate a population parameter, and occurs because samples vary. The sampling error tells us how far the sample statistic is from the population parameter. Usually we cannot determine this answer, but we must always be conscious that our sample will likely differ from the population.