Response Bias

- **Non-Response Bias**: You get no data or not enough data. E.g., 80% of people contacted refuse to answer a survey.
- **Questionnaire Bias**: Arises from the way the questions are asked.
  
  Example.
  - I would be disappointed if Congress cut its funding for public television.
  - Cuts in funding for public television are justified as part of an overall effort to reduce federal spending.

4.2 Randomizing: Playing It Safe by Taking Chances

- **Randomize**: Choose a sample by chance. This is the only method guaranteed to be unbiased.
- **Simple Random Sample (SRS)**
  
  In a SRS all possible samples of a given fixed size are equally likely. That is all units have the same chance of being in the sample, all possible triples of units have the same chance, and so on.

Simple Random Sample (SRS)

- **Steps in choosing a SRS**
  1. Start with a list of all units in the population. (a frame)
  2. Number the units in the list.
  3. Use a random number table or generator to choose units from the numbered list, one at a time, until you have as many as you need.
Activity 4.2
Part 1. (page 225)

- Quickly choose 5 rectangles.
- Calculate the areas of each of your 5 rectangles.
- Calculate the mean (average) of these areas.

Keep your sample data for future reference.

Results

Rectangles:
29, 46, 59, 71, 83
Areas:
10, 3, 8, 4, 2
Mean: \((10+3+8+4+2)/5\) = 5.4

Activity 4.2
Part 2.

- Choose 5 random numbers between 1 and 100. Look for the rectangles associated to these numbers.
  Use \texttt{randInt(1,100)}
- Calculate the areas of each of these 5 rectangles.
- Calculate the mean (average) of these areas.

Keep your sample data for future reference.

Results 1
(Computer Simulated \(n = 200\))
Results 2
(Computer Simulated $n = 1000$)

Stratified Random Samples

1. Divide the units of the sample into non-overlapping subgroups (strata)
2. Choose a SRS from each subgroup (stratum)

Choose the relative sample sizes proportional to the stratum sizes.

Why Stratify

- **Convenience.** It is easier to sample in smaller more compact groups.
- **Coverage.** Each stratum is assured to be covered. (this may not happen with a SRS)
- **Precision.** The results may be more precise if the measurement we are interested varies a lot from stratum to stratum.

Cluster Samples

1. Create a numbered list of all the clusters in the population.
2. Choose a SRS of clusters
3. Obtain data on each unit in each chosen cluster.
Two (or more) stage samples

1. Create a numbered list of clusters.
2. Choose a SRS of clusters.
3. From each selected cluster, create a list of individuals and choose a SRS from each (selected) cluster.

Systematic Samples with a Random Start.

1. By a method, such as counting off, divide your population into groups of the size you want for your sample.
2. Use a chance method to choose one of the groups for your sample.