36-303: Sampling, Surveys and Society

Components of a Survey

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Handouts

- Emailed to you:
  - Team Member Lists
- In Class:
  - Reading (538 and the Florida Primary)
  - Graded Quizzes
  - Today's Lecture Notes
- On http://www.stat.cmu.edu/~brian/303:
  - Topics Schedule
  - Project Schedule
  - HW01 – Due Jan 31!

Outline

- Quiz Results
- 538 and the Florida Primary
- Team Assignments; Project Schedule
- Process of Conducting a Survey
  - Defining Research Objectives
  - Mode of Data Collection; Target Population; Frame
  - Measurement; Errors of Observation
  - Sample; Errors of Non-Observation
  - Coding, Editing and Post-Survey Processing
  - Analyzing the Data, Writing the Report

Quiz Results

- Quiz scores:

```
4 | 2
4 |
5 |
5 | 7889
6 | 1
6 | 7
7 | 244
7 | 57
8 | 111122334
8 | 578
9 | 000111122244
9 | 6
```

median

- It was an easy quiz
  - 80 or above
    - Generally feel pretty good
    - Errors were sloppy or minor
  - Below 80 – a significant chunk is missing
    - Median/Outliers
    - Histogram/Boxplot
    - Confidence Interval
    - Scatterplot
    - Summation Notation
    - Expected Value
    - Binomial Distribution

Quiz Results (Cont'd)

- Most answers pretty obvious – ask your friends or check with us
- CI for Mean Test Performance…

```
N   Mean SE Mean StDev Minimum    Q1 Median    Q3 Maximum
93 82.61    1.06 10.21   58.00 77.00  84.00 91.00   99.00
```

$$\begin{aligned} \text{StDev} &= \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i-\overline{x})^2} = 10.21 \\ \text{SE Mean} &= \text{StDev}/\sqrt{n} = 1.06 \\ 95\%\ \text{CI} &= \text{Mean} \pm 1.96 \times (\text{SE Mean}) \\ &\approx (82.61 - 2 \times 1.06, 82.61 + 2 \times 1.06) \end{aligned}$$

Quiz Results (Cont'd)

$$\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i-\overline{x})^2}$$

- What is role of i?
- What is role of x_i?
- How do we calculate it?
- What is it?

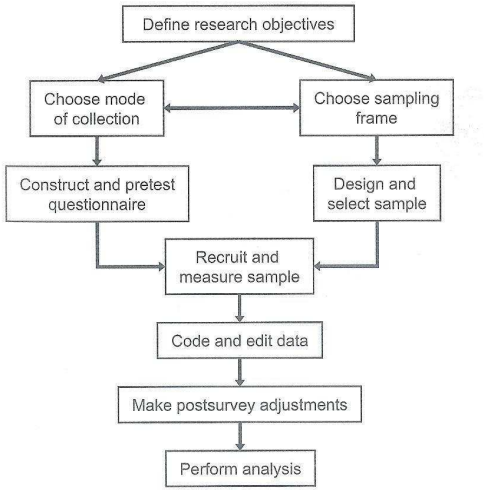
Team Assignments; Project Outline

- Team Member Lists – Emailed to You
  - As the projects get underway there may be some small adjustments in some teams
- Project Schedule – Posted on http://www.stat.cmu.edu/~brian/303
- Next deadline: Tue Jan 31: ***Propose two topics!***
- (HW01 is also due Tues Jan 31).

Wrapping up Previous Lecture

- Elements of a Sample
- Does Sample Represent Population?
- Non-sampling errors and Sampling Errors
- What can we say about
  - Population of Interest
  - frame/list
  - sampling technique
  - sample size
  - response rate
  - mode of interview
  - possible sources of selection bias and inaccuracy
  - other details of methodology relevant to our inferences

Process of Conducting a Sample Survey



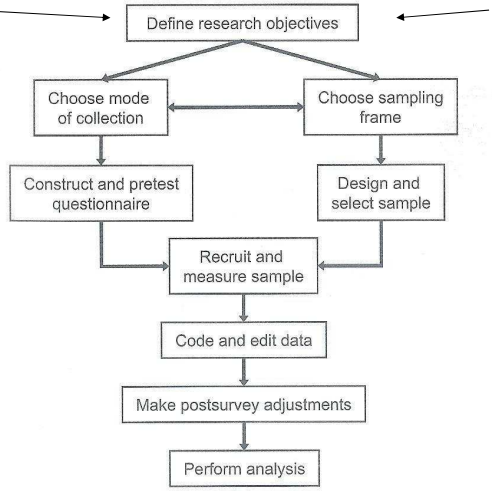
Defining Research Objectives

- **Research Question(s)**
  - Is it of interest? *(Who Cares??)*
  - Can it be answered with available methods?
  - Can a survey on it be conducted and analyzed within budget ($$, time, effort, irritation, …)?
  - Surveys are not well-suited to cause-effect questions (Why not? Think about 36-309…)
- **Target Population** *(This is harder than it sounds!)*
  - What population is relevant to the question?
  - What population can you construct a good sampling frame for?
- **Construct** *(What information do you seek?)*
  - *"Number of jobs created in last month"*
  - *"Consumption of beer in the last month"*
  - *"Knowledge in mathematics of eighth grade school children"*
  - *"Optimism about one's financial status"*

Process of Conducting a Sample Survey

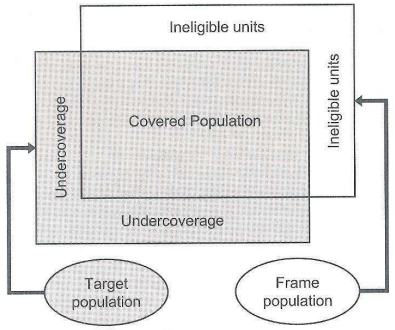
- Question
- Construct

- Target Population



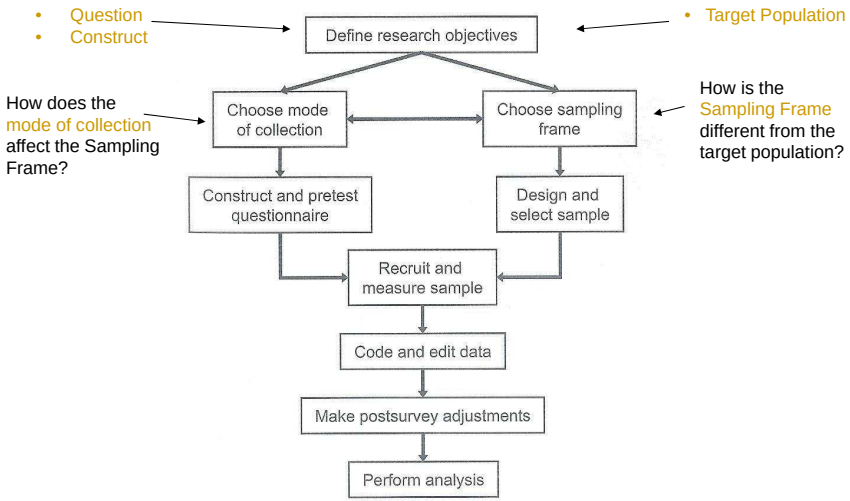
Mode of Data Collection and Sampling Frame

- Why Sampling Frame ≠ Target Population?
  - Population may not have a natural frame
  - Mode of data collection may restrict frame
- Mode of Data Collection
  - Interview
    - Face to face?
    - Telephone?
  - Self-report
    - Face to face?
    - Internet?
  - Direct
    - Administrative records?
    - Observe prices, soil samples, type of nbhd, etc.



Coverage Error – *the extent to which the Sampling Frame does not cover the Target Population*

Process of Conducting a Sample Survey



Measurement; Response; Errors of Observation

- Measurement: How we gather information for constructs
  - Chemical analyses of soil samples
  - Electronic measures of traffic flow
  - Observations of classroom teaching
- Questions posed to respondent are common
  - Oral (face-to-face interview)
  - Visual (self-report or computer-assisted interview)
  - Based on some stimulus (reaction to watching a video, listening to music, reading a story)

Measurement; Response; Errors of Observation

- Responses depend on the form of the question
  - Multiple choice
  - Fill in the blank
  - Longer user-generated response
- Nonresponse
  - Didn't understand, didn't see, or refused question (item nonresponse)
  - Not home, not approached by interviewer, refused phone call, etc. (unit nonresponse)

Measurement; Response; Errors of Observation

- Errors of Observation (Measurement Error)
  - Deviations of measurement from underlying construct
  - Inaccurate measurements
    - Inaccurate administrative records
    - Poor chemical analysis of soil
    - Untrained interviewers/observers
    - Memory/attention/understanding/truthfulness of respondents
  - Item Nonresponse

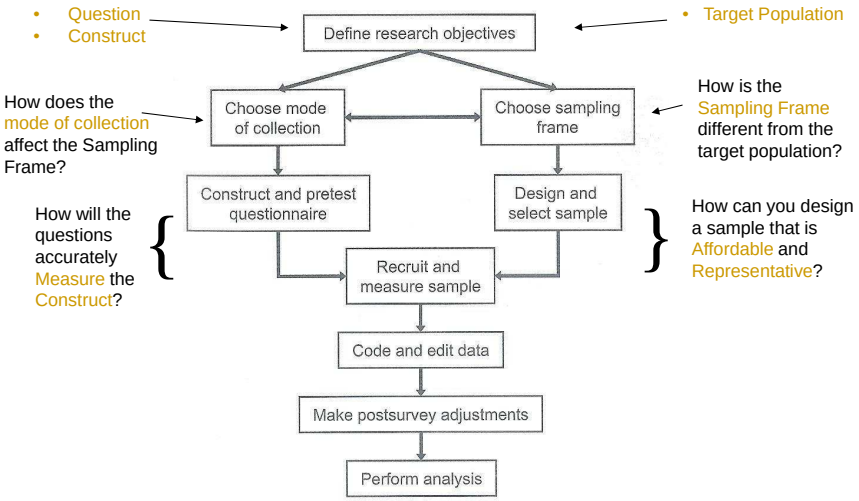
Designing a Sample; Errors of Non-Observation

- We want to design a sample that is
  - Affordable (time, money, effort, accessibility…)
  - Representative (of the frame? Of the target population?)
- Simple populations with good frames
  - Simple sample designs and analyses suffice
- Complex populations or poor frames
  - Stratified sampling and Clustered sampling common
  - More complex designs require more complex analyses
- Followup for Unit Nonresponse?

Designing a Sample; Errors of Non-Observation

- Errors of Non-Observation
  - Deviations between the sample and the target population.
  - How representative of the Sampling Frame is the Sample?
  - How representative of the Target Population is the Sampling Frame (Coverage Error…)
  - How do we followup unit nonresponders?
    - Sample more units to replace them?
    - Keep after them until they respond?

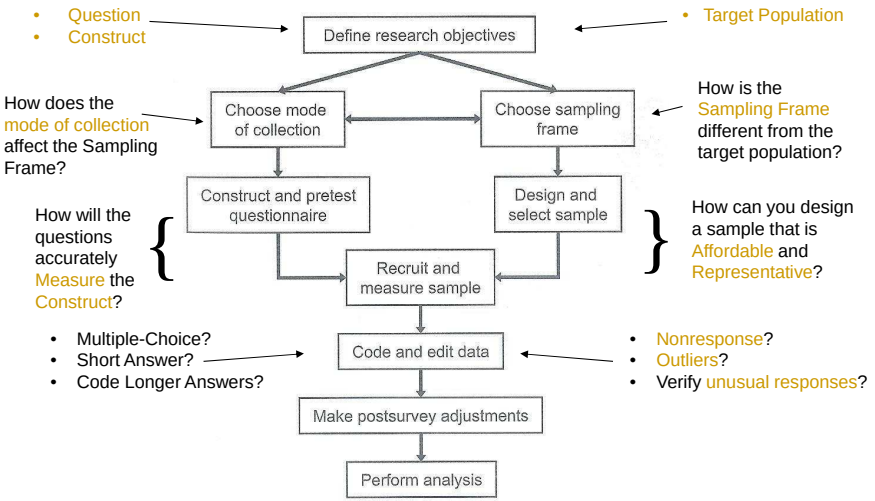
Process of Conducting a Sample Survey



Coding and Editing Data

- Coding depends on measurements
  - Multiple choice?
  - Fill in the blank, long-answer, taped conversation?
  - Accuracy of chemical analysis?
- Nonresponse
  - Unit nonresponse? Successful Followups?
  - Item nonresponse? Refused? Not asked? Not reached? Not understood?
- Outliers
  - What is an outlier?
  - Include anyway? Drop?
  - Followup to verify value?
- Inaccurate Data
  - Detection? Followup? Correct value? Drop case?

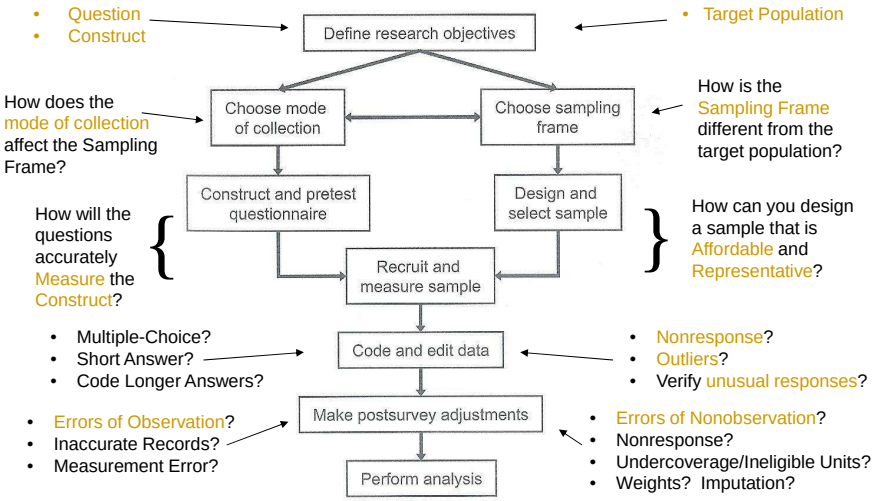
Process of Conducting a Sample Survey



Post-Survey Adjustments

- Adjustments for
  - Patterns of unit nonresponse (did women respond less than men?)
  - Under- or over-coverage of the sampling frame (no phone numbers for homeless men?)
  - Inaccurate or outlying data, …
- Weights (only 20% of sample was women but 50% of population are women, so "weight up" women by 5/2)
- Impute missing values (unit nonresponse and item nonresponse)

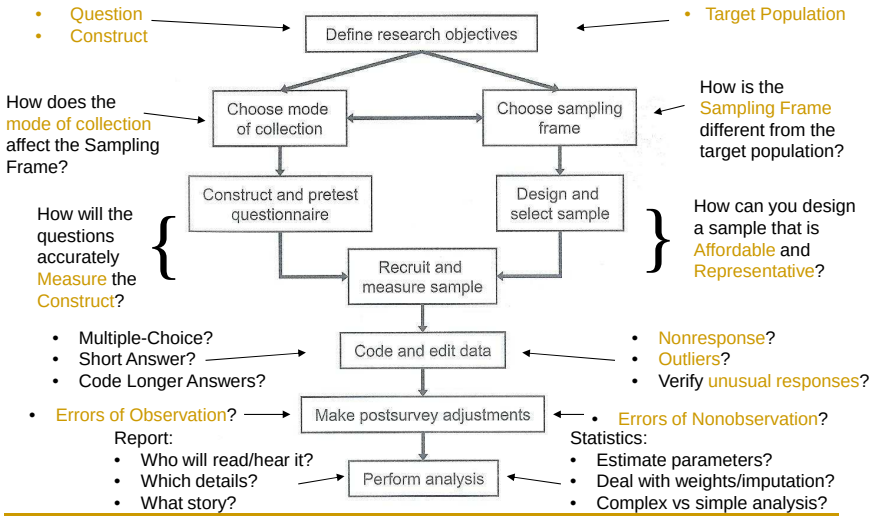
Process of Conducting a Sample Survey



Performing the Analysis

- Statistical analysis
  - What quantities should be estimated? How?
  - Do we have to deal with weights? Imputation?
  - Simple designs can use simple statistics; complex designs require complex statistics
  - Statistics cannot fix (or even quantify!) all errors
- Report writing
  - Who will read the report? ***How*** will they read it?
  - How much detail is needed? Where should it go?
  - What is the interesting story you are trying to tell?
    - Research objectives: Who Cares???

Process of Conducting a Sample Survey



Review

- Quiz Results
- Team Assignments
- Process of Conducting a Survey
  - What are the various components of a survey?