1. **For the following survey, describe briefly the *target population*, the *sampling frame* and the *frame population*, and the sampled population (or the *study population*). Discuss possible problems/issues with the sampling frames and the survey data in terms of coverage error and nonresponse bias:**
A survey conducted by the Dean of Mathematics at University of Waterloo (UW) indicates that about 25% of UW Computer Science graduates went to positions in the United States. Data were collected through questionnaires emailed to graduates from the past 5 years.

Response:

The *target population* for the survey is University of Waterloo (UW) Computer Science graduates. They are the main focus of the study and the survey aims to gather information about their career paths they took specifically in United States.

The *sampling frame* and the *frame population* The sampling frame is the list of University graduates from the past 5 years. The frame population is the actual population from which the sample will be taken and it will comprise of those individuals who completed their Computer Science degree within the specific time frame.

The sampled population (or the *study population*)

The sampled population, or study population refers to those individuals who received the survey questionnaires. In this case, it includes those graduates who were sent the email questionnaires.

Discussion of possible problems/issues with the sampling frames and the survey data in terms of coverage error and nonresponse bias

If the sampling frame does not accurately represent all recent Computer Science graduates from UW, there could be **underrepresentation** issues and thereby **coverage error**. For example, if some graduates did not provide updated contact information, they might be excluded from the survey, leading to a biased sampling. The use of email questionnaires may result in a low response rate. Graduates who do not regularly check their university email or who have graduated a while ago may be less likely to respond, introducing nonresponse bias. Those who chose to respond might have different characteristics than those who did not. For instance, individuals who successfully found positions in the United States might be more motivated to share their experiences, leading to a **biased representation** and therefore **nonresponse bias**.

The survey may not capture the long-term career routes of recent graduates accurately. Some may still be in the process of securing positions, while others might not have updated their career information since graduation resulting in **timing issues of sampling**.

To mitigate these issues, the Dean of Mathematics could employ strategies such as using alternative contact methods, incentivizing responses, and ensuring the sampling frame is

as comprehensive as possible. Additionally, efforts should be made to analyze and account for potential biases in the interpretation of survey results.

2. **For the following survey, describe briefly the *target population*, the *sampling frame* and the *frame population*, and the *sampled population* (or the *study population*). Discuss possible problems/issues with the sampling frames and the survey data in terms of coverage error and nonresponse bias:**
A pilot survey for The Canadian Longitudinal Study on Aging (CLSA) was conducted in the province of Ontario. The survey intended to cover the general population of the province with age 45–80 (inclusive). Survey questionnaires were sent to selected individuals through regular mail. Individuals and their mailing addresses were selected and obtained from the Provincial Health Records.

   Response:

   The *target population* The survey targets the broader population of individuals aged 45 to 80 within the province of Ontario. The objective is to gather insights from this specific age group for The Canadian Longitudinal Study on Aging (CLSA).

   The *sampling frame* and the *frame population* The sampling frame draws from the Provincial Health Records, encompassing individuals aged 45 to 80 in Ontario. The frame population comprises those individuals whose information is accessible through the Provincial Health Records.

   the *sampled population* (or the *study population*) The sampled population, or study population, includes the individuals selected from the Provincial Health Records in Ontario who received the pilot survey through regular mail.

   Discussion on possible problems/issues with the sampling frames and the survey data in terms of coverage error and nonresponse bias:

   Incomplete or inaccurate Provincial Health Records may result in the exclusion of certain individuals within the target age group. This could introduce a **coverage error**, limiting the survey's ability to fully represent the intended population. Mailed surveys often contend with **low response rates**. Some individuals may opt not to participate, leading to nonresponse bias. This is particularly relevant if selected individuals lack the motivation to complete and return the mailed survey. Utilizing Provincial Health Records raises **privacy concerns**, potentially causing hesitation among individuals to participate. This concern might contribute to a biased sample of respondents.

   The sampling frame limitations may occur if the Provincial Health Records disproportionately represent or omit specific demographic groups, the survey outcomes may not accurately reflect the diversity within the target population.

3. **For the following survey, describe briefly the *target population*, the *sampling frame*, the *sampling unit*, and *observation unit*. Discuss any possible sources of selection bias or inaccuracy of responses:**
The December 2003 issue of PC World reported the results from a survey of over 32,000

subscribers asking about reliability and service for personal computers and other electronic equipment. The magazine "invited subscribers to take the Web-based survey from April 1 through June 30, 2003" and received 32,051 responses. Survey respondents were entered in a drawing to win prizes. They reported that 46% of desktop PCs had at least one significant malfunction.

The *Target population*: The target population for this survey is the subscribers of PC World magazine who own personal computers and other electronic equipment. The survey aims to gather information about the reliability and service of these devices as reported by the magazine's subscribers

The *sampling frame:* The sampling frame is the list of subscribers to PC World magazine. It serves as the source from which the sample is drawn, consisting of individuals who have an active subscription to the magazine.

The sampling unit: is the individual subscriber to PC World magazine. Each subscriber is considered a separate unit eligible to be included in the survey. Subscribers are the primary focus for selecting participants in the survey.

***The observation unit*:** The observation unit is the individual response from a subscriber who participated in the survey. Each response represents the information provided by a single subscriber regarding the reliability and service of their personal computers and electronic equipment.

Possible sources of selection bias or inaccuracy of responses:

Since participation in the survey was **voluntary,** individuals who chose to respond may differ from those who did not participate. Subscribers who had strong opinions or experiences, either positive or negative, may have been more inclined to take the survey, leading to a potential bias in the reported results. The survey was conducted within a **specific time frame** (April 1 through June 30, 2003). If certain events or technological changes occurred around that time, the survey results might not capture the broader context over an extended period.

To address these issues, researchers should be transparent about the survey's limitations, acknowledge potential biases, and consider strategies to encourage ***participation from a more diverse subset of subscribers***.

4. **Consider a situation where a population's size is $N = 3$ and the population U is {1, 2, 3}. There are seven possible candidate samples:**

$$S_1 = \{1\}, \; S_2 = \{2\}, \; S_3 = \{3\}, \; S_4 = \{1,2\}, \; S_5 = \{1,3\}, \; S_6 = \{2,3\}, \; S_7 = \{1,2,3\}.$$

Note that S7 = U, which corresponds to a census. Here are two sampling designs:

$$P(S_k) = ⅙, k = 1, 2,..., 6 and P(S_7) = 0.$$

$$P(S_k) = ⅓, k = 4, 5, 6 and P(S_k) = 0, k = 1,2,3,7.$$

Let $πi = P(i ∈ S)$ be the probability that unit i from U is included in the sample. For each of the two probability sampling designs, calculate the inclusion probabilities $π1$, $π2$, and $π3$.

Solution:

The inclusion probability, πi for unit *i* in the population U is given by the sum of the probabilities of being included in each possible sample Sk. The formula is:

$$\pi i=\sum kP(Sk)\cdot I(i\in Sk)$$

where I(i∈Sk) is an indicator function that equals 1 if *i* is in Sk and 0 otherwise.

Lets calculate π1, π2, and π3for both sampling designs:

Sampling Design 1:

P(Sk) = 1/6, k = 1,2, …, 6 and P (S7) = 0

For π1 = 1/6 + 1/6 + 1/6 +1/6 = 2/3

For π2 = 1/6 + 1/6 + 1/6 = 1/3

For π3 = 1/6 + 1/6 + 1/6 = 1/3

Sampling Design 2:

P(Sk) = 1/3, k = 4,5,6 and P (Sk) = 0, k = 1,2,3,7

For π1 = 0

For π2 = 0

For π3 = 0

In Sampling Design 2, the inclusion probabilities for units 1, 2, and 3 are all zero, indicating that none of these units are selected in any sample. This is consistent with the design that excludes the elementary samples containing these units.

5. Frankovic (2008) reported that in 1970, a poll conducted by the Harris organization for Virginia Slims, a brand of cigarettes marketed primarily to women, had the following question: **“There won’t be a woman president of the U.S. for a long time and that’s**

probably just as well." Sixty-seven percent of female respondents agreed with the statement. Critique this question.

Response:

This question is critiqued for its **biased and sexist framing**. The use of language suggesting that having a woman president is "probably just as well" implies negative assumptions about women's suitability for leadership roles, reinforcing gender stereotypes. The question's binary response options and lack of a neutral choice limit the expression of nuanced views. Furthermore, the affiliation with Virginia Slims raises concerns about sponsor influence on survey results, and the survey's context in 1970 may not be representative of evolving societal attitudes towards gender roles and women's rights.

6. **The following questions, quoted in Kinsley (1981), were from a survey conducted by Cambridge Reports, Inc., and financed by Union Carbide Corporation. Critique these questions:**

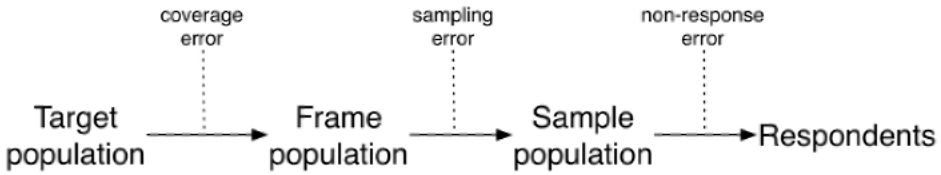
   a. *Some people say that granting companies tax credits for the taxes they actually pay to foreign nations could increase these companies' international competitiveness. If you knew for a fact that the tax credits for taxes paid to foreign countries would increase the money available to US companies to expand and modernize their plants and create more jobs, would you favor or oppose such a tax policy?*

   Response
   The question, raises concerns regarding ***loaded language and potential bias.*** The question is framed in a way that strongly emphasizes the positive outcomes of the proposed tax policy, such as increasing international competitiveness, expanding and modernizing plants, and creating more jobs. This framing may influence respondents toward a favorable stance by presenting a scenario with primarily positive consequences, potentially leading to an inaccurate reflection of public opinion. A more neutral and balanced phrasing that includes potential drawbacks or alternative perspectives would provide a more accurate measure of public sentiment.

   b. Do you favor or oppose changing environmental regulations so that while they still protect the public, they cost American businesses less and lower product costs?

   Response
   The question presupposes that environmental regulations inherently increase costs for businesses and implies a trade-off between environmental protection and economic considerations. This binary presentation oversimplifies a complex issue, potentially leading respondents to choose between conflicting priorities without recognizing potential middle-ground solutions. A more effective question would provide a nuanced exploration of respondents' views on balancing environmental concerns with economic considerations, allowing for a more comprehensive understanding of public opinion on the matter.

7. **Observe Figure 3.2 in Salganik (2018).**



a. Describe a situation in which these errors cancel out.

In a situation where the coverage error in the target population is caused by an underrepresentation of a specific demographic group, but this group is proportionally well-represented in the frame population, the ***errors could cancel out***. For example, if the target population consists of residents of a city, and the coverage error is due to missing information from a particular neighbourhood, but the frame population (data source) includes a representative sample of individuals from that neighbourhood, the subsequent sampling and non-response errors might be mitigated. If the sample population and respondents maintain this representative distribution, the errors might cancel out, leading to a more accurate reflection of the target population.

b. Describe a situation in which these errors compound.

Conversely, **errors can compound** in a situation where there is a systematic bias introduced at each stage. For instance, if the coverage error in the target population disproportionately excludes a specific demographic group, and this exclusion is perpetuated in the frame population, sampling error and non-response error may further amplify this bias. If the sample population is then drawn from this biased frame, the compounding effect continues, potentially resulting in a sample that does not adequately represent the diversity of the target population. This scenario highlights how errors at different stages of the survey process can accumulate and lead to a final sample that is significantly skewed or biased.

8. **Let N = 6 and n = 3. For purposes of studying sampling distributions, assume that all population values are known.**

We are interested in the population mean. Two sampling plans are proposed.

Sample Number	Sample, S	P(S)	Sample Number	Sample, S	P(S)
1	{1, 3, 5}	⅛	1	{1, 4, 6}	¼

Sample Number	Sample, S	P(S)	Sample Number	Sample, S	P(S)
2	{1, 3, 6}	⅛	2	{2, 3, 6}	¼
3	{1, 4, 5}	⅛	3	{1, 3, 5}	½
4	{1, 4, 6}	⅛			
5	{2, 3, 5}	⅛			
6	{2, 3, 6}	⅛			
7	{2, 4, 5}	⅛			
8	{2, 4, 6}	⅛			

a.What is the value of the sample mean?

Value of sample mean

To find the sample mean ($\bar{y}$) sum the values in each sample and divide by the sample size (n:$\bar{y}1=1+3+53=3\bar{y}2=1+3+63=3.33$ $\bar{y}3=1+4+53=3.33$, $\bar{y}4=1+4+63=3.67$, $\bar{y}5=2+3+53=3.33$, $\bar{y}6=2+3+63=3.67$, $\bar{y}7=2+4+53=3.67\bar{y}8=2+4+63=4$)

b. Let y be the mean of the sample values. For each sampling plan, find E(y) and Var(y).

For Sampling Plan 1:

$E(y)1\approx3.625$

$Var(y)1\approx0.1172$

For Sampling Plan 2:

$E(y)2\approx3.563$

$Var(y)2\approx0.223$

c. Which sampling plan do you think is better? Why?

Sampling Plan 1 has a slightly higher expected value and lower variance than Sampling Plan 2. Therefore, from a purely statistical perspective, Sampling Plan 1 could be considered better as it has a higher expected mean and less variability. However, the choice between the two plans may also depend on the specific goals and considerations of the study

9. **Discuss whether an SRS would be appropriate for the following situations. What other designs might be used?**

    a. ***You want to estimate the percentage of topics in a medical website that have errors.***

Response: An SRS (Simple Random Sample) may not be the most appropriate design for this situation. Given the nature of a medical website, it is likely that errors may be concentrated in specific sections or topics. In such cases, a more targeted sampling design, such as Stratified Random Sampling, could be more effective. This involves dividing the website into strata (e.g., different medical topics or sections) and then randomly sampling within each stratum. This way, the sample is more likely to capture the variation in error rates across different areas of the website.

b. A county election official wants to assess the accuracy of the machine that counts the ballots by taking a sample of the paper ballots and comparing the estimated vote tallies for candidates from the sample to the machine counts.

Response: An SRS might not be the most suitable design in this scenario either. A more appropriate approach could be to use a Systematic Sampling design. With systematic sampling, every kth ballot is selected for examination. This allows for a structured examination of a representative sample of ballots without introducing bias. Additionally, if there are concerns about specific precincts or groups of voters, Stratified Random Sampling could be applied by dividing the county into strata based on different precincts or demographic characteristics, and then sampling systematically within each stratum. This ensures that the sample is representative of different segments of the population, providing a more thorough assessment of the voting machine's accuracy.

10. Suppose that a city has 90,000 dwelling units, of which 35,000 are houses, 45,000 are apartments, and 10,000 are condominiums. You believe that the mean electricity usage is about twice as much for houses as for apartments or condominiums, and that the standard deviation is proportional to the mean so that S1 = 2S2 = 2S3.

    How would you allocate a stratified sample of 900 observations if you wanted to estimate the mean electricity consumption for all households in the city?

    Response:

    To allocate a stratified sample of 900 observations to estimate the mean electricity consumption for all households in the city, we need to determine the sample sizes for each stratum (houses, apartments, and condominiums) based on the proportion of each dwelling unit type in the population. Given that the standard deviation is proportional to the mean, we can allocate the sample proportionally.

    Let:

    N1 be the total number of houses (35,000)

    N2 be the total number of apartments (45,000),

    N3 be the total number of condominiums (10,000)

n be the total sample size (900).

Calculate the proportion of each stratum in the population. Allocate the stratified sample based on these proportions.

N1 = p1 x n

N2 = p2 x n

N3 = p3 x n

Given the relationship between the standard deviations (S1, S2, S3) and means, you can also allocate the sample sizes in proportion to the square root of the means. Substitute the appropriate values for mean_1, mean_2, and mean_3, and then calculate the sample sizes n1, n2 and n3 accordingly.

11. **What stratification variable(s) would you use for each of the following situations:**

a.A political poll to estimate the percentage of registered voters in Arizona that approve of the governor's performance.

Response:

For a political poll in Arizona to estimate the percentage of registered voters approving of the governor's performance, a suitable stratification variable would be "Political Affiliation" or "Party Registration." This variable could include strata such as Democrats, Republicans, Independents, and other political affiliations. Stratifying by political affiliation ensures representation from diverse segments of the registered voter population, providing more nuanced insights into approval ratings across different political groups.

b. A sample of public libraries in California to study the availability of computer resources, and the per capita expenditures.

Response:

In a study of public libraries in California focusing on computer resources and per capita expenditures, two potential stratification variables could be "Library Size" and "Geographic Region." Stratifying by library size (e.g., small, medium, large) helps ensure representation from libraries of different capacities, which may influence their computer resources and expenditures. Additionally, stratifying by geographic region (e.g., Northern California, Central California, Southern California) allows for an examination of variations in computer resources and spending patterns across different parts of the state.

c. An aerial survey to estimate the number of walrus in the pack ice near Alaska between 173 degrees East and 154 degrees West longitude.

For an aerial survey estimating the number of walrus in the pack ice near Alaska between 173 degrees East and 154 degrees West longitude, a suitable stratification variable would be "Ice Type" or "Habitat Characteristics." Different strata could include open water, consolidated ice, and broken ice. Stratifying by ice type helps account for variations in walrus distribution based on habitat characteristics, ensuring that the survey captures the population density in different ice conditions.

12. **A city council of a small city wants to know the proportion of eligible voters that oppose having an incinerator of Phoenix garbage opened just outside of the city limits. They randomly select 100 residential numbers from the city's telephone book that contains 3,000 such numbers. Each selected residence is then called and asked for (a) the total number of eligible voters and (b) the number of voters opposed to the incinerator. A total of 157 voters were surveyed; of these, 23 refused to answer the question. Of the remaining 134 voters, 112 opposed the incinerator, so the council estimates the proportion by with: $p = 112/134 = 0.83582$ and $V(p) = 0.83582(1 - 0.83582)/134 = 0.00102$. Are these estimates valid? Why, or why not?**

Response:

The estimates provided for the proportion of eligible voters opposing the incinerator ($p=0.83582$) and the variance of the proportion ($V(p)=0.00102$) are valid based on the information given. However, there are a few considerations and potential limitations in the survey methodology:

- The sample size of 134 voters is reasonably large, but it's important to ensure that the selected residences and respondents are representative of the entire eligible voter population. The random selection from the telephone book is a good approach, assuming it provides a fair representation of the city's residents.
- The refusal rate of 23 out of 157 surveyed voters (approximately 15%) might introduce nonresponse bias. If those who refused to answer have different opinions than those who responded, the estimates could be biased. The extent of this bias depends on the reasons for nonresponse and the characteristics of those who refused.
- The survey relies on self-reported information about the total number of eligible voters and the number opposed to the incinerator. Respondents may provide inaccurate information due to memory lapses or social desirability bias, especially if they feel a particular response is more socially acceptable.
- The validity of the estimates assumes that each respondent's opinion is independent of others. If there are clusters of respondents with similar views (e.g., if certain neighborhoods have more similar opinions), this independence assumption may be violated.

- The standard error and variance calculations suggest that the estimates are precise. However, the precision depends on the sample size and variability in responses. The relatively low standard error indicates a relatively tight confidence interval around the estimated proportion.

In summary, while the estimates are provided based on the data, the validity of these estimates depends on the assumptions made during the survey and potential biases introduced by nonresponse and self-reporting. The considerations mentioned should be taken into account when interpreting the results and generalizing them to the broader eligible voter population.

13. Kleppel et al. (2004) report on a study of wetlands in upstate New York. Four wetlands were selected for the study: Two of the wetlands drain watersheds from small towns and the other two drain suburban watersheds. Quantities such as pH were measured at two to four randomly selected sites within each of the four wetlands. **Describe why this is a cluster sample. What are the psus? The ssus? How would you estimate the average pH in the suburban wetlands?**

    Response:

    This study is an example of a cluster sample because the sampling is done in groups or clusters, where each cluster represents a wetland. The wetlands are chosen as whole units, and within each wetland, measurements are taken at multiple sites. This is in contrast to a simple random sample where individual measurement locations would be randomly selected without regard to wetland groupings.

    In this study, the **primary sampling units** (psus) are the wetlands themselves. There are four wetlands, and they are selected based on whether they drain watersheds from small towns or suburban areas.

    The **secondary sampling units** (ssus) are the individual sites within each wetland where measurements, such as pH, are taken. Each wetland comprises multiple measurement sites, and these sites are the secondary units within each wetland.

    To estimate the average pH in suburban wetlands, you would calculate the average pH for all the measurement sites within the suburban wetlands. This involves pooling the pH data from all the selected sites within the suburban wetlands and computing the mean. The average pH in the suburban wetlands is then estimated based on the measurements taken at these specific sites, considering the cluster nature of the sample. This method accounts for the variability within each wetland and provides an overall estimate for the suburban wetlands in the study area.

14. The new candy Green Globules is being test-marketed in an area of upstate New York. The market research firm decided to sample 6 cities from the 45 cities in the area and then to sample supermarkets within cities, wanting to know the number of cases of Green Globules sold.

City	Number of Supermarkets	Number of Cases Sold
1	52	146, 180, 251, 152, 72, 181, 171, 361, 73, 186
2	19	99, 101, 52, 121
3	37	199, 179, 98, 63, 126, 87, 62
4	39	226, 129, 57, 46, 86, 43, 85, 165
5	8	12, 23
6	14	87, 43, 59

Obtain summary statistics for each cluster. Estimate the total number of cases sold, and the average number sold per supermarket, along with the standard errors of your estimates.

Response:

City 1:

Total Cases Sold: 1743

Average Cases Sold per Supermarket: 1743/52 ≈ 33.52

Average Deviation of cases sold: | (where xi is each observation,

City 2:

Total Cases Sold: 373

Average Cases Sold per Supermarket: 373/19 ≈ 19.63

City 3:

Total Cases Sold: 814

Average Cases Sold per Supermarket: 814/37 ≈ 22

City 4:

Total Cases Sold: 838

Average Cases Sold per Supermarket: 838/39 ≈ 21.49

City 5:

Total Cases Sold: 35

Average Cases Sold per Supermarket: 35/8 ≈ 4.38

City 6:

Total Cases Sold: 189

Average Cases Sold per Supermarket: 189/14 ≈ 13.5

Estimates for the Entire Test Market area:

Total Cases Sold (Estimate): Sum of the total cases sold in each city.

1743 + 373 + 814 + 838 + 35 + 189 = 3992

Average Cases Sold per Supermarket (Estimate): Weighted average of the average cases sold per supermarket in each city, where the weights are the number of supermarkets in each city:

(52 x 33.52)+(19 x 19.63) + (37 x 22) + (39 x 21.49) + (8 x 4.38) + (14 x 13.5) / 52+ 19+37+ 39+8+14

15. The American Council of Learned Societies (ACLS) used a stratified random sample of selected ACLS societies in seven disciplines to study publication patterns and computer and library use among scholars who belong to one of the member organizations of the ACLS (Morton and Price, 1989). The data are shown in the table below.

Discipline	Membership	Number Mailed	Valid Returns	Female Members (%)
Literature	9,100	915	636	38

Discipline	Membership	Number Mailed	Valid Returns	Female Members (%)
Classics	1,950	633	451	27
Philosophy	5,500	658	481	18
History	10,850	855	611	19
Linguistics	2,100	667	493	36
Political Science	5,500	833	575	13
Sociology	9,000	824	588	26
Totals	44,000	5,385	3,835	

Calculate the response rate in each stratum for the survey. Is there evidence that the nonresponse rate varies among the strata, or that it is related to the percentage female membership?

16. Kosmin and Lachman (1993) had a question on religious affiliation included in 56 consecutive weekly household surveys; the subject of household surveys varied from week to week from cable TV use, to preference for consumer items, to political issues. After four callbacks, the unit nonresponse rate was 50%; an additional 2.3% refused to answer the religion question. The authors say: "Nationally, the sheer number of interviews and careful research design resulted in a high level of precision . . . Standard error estimates for our overall national sample show that we can be 95% confident that the figures we have obtained have an error margin, plus or minus, of less than 0.2%. This means, for example, that we are more than 95% certain that the figure for Catholics is in the range of 25.0% to 26.4% for the U.S. population."

Response:

a. Critique the preceding statement.
   - The claim of a unit nonresponse rate of 50% after four callbacks raises concerns about the representativeness of the final sample. A high nonresponse rate can introduce bias if nonrespondents differ systematically from respondents in ways that affect the variable of interest (religious affiliation, in this case).

- The additional 2.3% refusing to answer the religion question is also notable, as it contributes to the overall nonresponse and may introduce further bias.
- While the authors assert a high level of precision and a small standard error, these claims are based on assumptions about the randomness of nonresponse and refusal patterns. If nonresponse is not random, the precision of estimates may be overestimated.
- The narrow confidence interval mentioned (plus or minus 0.2%) is contingent on the assumptions being met. The actual level of precision could be different if biases exist.

b. If you anticipated item nonresponse, do you think it would be better to insert the question of interest in different surveys each week, as was done here, or to use the same set of additional questions in each survey? Explain your answer. How would you design an experiment to test your conjecture?

Response:

- The decision to insert the question of interest in different surveys each week may help mitigate boredom or respondent fatigue, potentially reducing item nonresponse. However, this approach also poses challenges in terms of consistency across surveys and the comparability of results.
- Using the same set of additional questions in each survey can provide a controlled environment, ensuring consistency and comparability. Respondents might become more familiar with the questionnaire over time, potentially reducing item nonresponse.
- An experiment to test the impact of survey design on item nonresponse could involve randomizing surveys into two groups: one with the same set of additional questions each week and another with different additional questions. Comparing item nonresponse rates and response patterns between the two groups would help assess the effectiveness of each approach.

It's important to recognize that the choice between different surveys each week and a consistent set of questions depends on the specific goals of the study, potential respondent fatigue, and the desire for comparability across surveys. Each approach has its advantages and trade-offs.

17. The goal of the National Comorbidity Survey Replication is to estimate the prevalence of mental disorders in the United States. Read the survey description by Kessler et al. (2004). **What aspects of this survey might affect data quality? What design features were implemented to improve the quality of the survey?**

Response:

The National Comorbidity Survey Replication (NCS-R) aimed to estimate the prevalence of mental disorders in the United States. The survey, conducted between February 2001 and April 2003, employed a face-to-face administration using computer-assisted personal

interviews (CAPI) conducted by professional interviewers from the University of Michigan. The decision for face-to-face administration was driven by superior coverage properties, accurate screening and household enumeration procedures, and higher response rates compared to other survey modes. CAPI was chosen over paper-and-pencil administration to mitigate interviewer errors, offer cost-effectiveness, and allow for immediate issue resolution during the interview. Despite the potential advantages of audio computer-assisted self-administered interviewing (A-CASI) in reporting sensitive behaviours, concerns about non-comparability with previous surveys and the impact on project timelines led to the decision not to use A-CASI. The survey design also accommodated the need for administering interviews in multiple sessions, either in person or over the telephone in specific situations, enhancing flexibility and respondent comfort while minimizing interruptions in the data collection process. Overall, these methodological choices aimed to optimize data quality in the NCS-R by balancing methodological rigour, respondent engagement, and practical considerations.

18. One problem that has occurred in surveys on sexual behavior in the United States is that, typically, men report more opposite-sex sexual partners than women do. This has led some researchers to be skeptical of the data quality, since one would expect the total number of opposite-sex partners for men to equal the total number of opposite-sex partners for women. Read the article by Tourangeau and Smith (1996) on asking sensitive questions. **What steps did the authors take to reduce measurement error in their study?**

    Response:

    The study compared three survey data collection methods—computer-assisted personal interviewing (CAPI), computer-assisted self-administered interviewing (CASI), and audio computer-assisted self-administered interviewing (ACASI)—to investigate their impact on reporting sensitive topics, including sexual behaviors. Conducted with a sample of over 300 adults in Cook County, Illinois, the research examined open and closed questions about the number of sex partners, varying the context of the sex partner items. Although response rates were consistent across the three modes, the method of data collection influenced the reporting of sensitive behaviors, with both forms of self-administration (CASI and ACASI) mitigating the disparity between men and women in reported numbers of sex partners. ACASI, in particular, increased the admission of illicit drug use. Additionally, the framing of closed answer options influenced reported sex partner numbers, indicating that emphasizing the low end of the distribution yielded fewer partners compared to emphasizing the high end, while responses to open-ended questions generally fell between the two closed versions.

References

- Frankovic, K. (2008). Race, gender, and bias in the electorate. Retrieved March 4, 2022, from https://www.cbsnews.com/news/race-gender-and-bias-in-the-electorate/

- Kessler, R. C., Berglund, P., Chiu, W. T., Demler, O., Heeringa, S., Hiripi, E., et al. (2004). The US National Comorbidity Survey Replication (NCS-R): Design and field procedures. *International Journal of Methods in Psychiatric Research, 13, 69–92.*
- Kleppel, G. S., Madewell, S. A., and Hazzard, S. E. (2004). Responses of emergent marsh wetlands in upstate New York to variations in urban typology. *Ecology and Society, 5*, Retrieved from www.ecologyandsociety.org/vol9/iss5/art1.
- Kinsley, M. (1981). The art of polling. *New Republic, 184*, 16–19.
- Kosmin, B. A., and Lachman, S. P. (1993). *One nation under God: Religion in contemporary American society.* New York, NY: Harmony Books.
- Morton, H. C., and Price, A. J. (1989). *The ACLS survey of scholars: Final report of views on publications, computers, and libraries.* Washington, DC: University Press of America.
- Salganik, M. J. (2018). *Bit by bit: Social research in the digital age.* Princeton, NJ: Princeton University Press.
- Tourangeau, R., and Smith, T. W. (1996). Asking sensitive questions: The impact of data collection mode, question format, and question context. *Public Opinion Quarterly, 60*, 275–304.