GROUND RULES:

- **Print** your full name clearly at the top of this page. Use the name that appears on university records.
- This is a closed-book and closed-notes exam. You can not use external notes of any kind.
- You may use a calculator. You may not use your phone as a calculator.
- This exam contains three parts:
  - Part 1. Multiple Choice. 25 questions, 2 points each (**50 points** total)
  - Part 2. Short Answer. 1 question, 10 points each **(10 points** total)
  - Part 3. Extra Credit. 1 question (5 points total).

  This exam is worth **60 points** (but it is possible to get up to 65 points).
- Any discussion or inappropriate communication between you and another examinee, as well as the appearance of any unnecessary material, is not allowed. All violations will be reported to the Student Conduct and Academic Integrity Office immediately.
- You have **50 minutes** to complete this exam.

HONOR PLEDGE FOR THIS EXAM:

After you have finished the exam, please read the following statement and sign your name below it.

> *I promise that I did not discuss any aspect of this exam with anyone other than the instructor, that I neither gave nor received any unauthorized assistance on this exam, and that the work presented herein is entirely my own.*

PART 1: MULTIPLE CHOICE. Circle the best answer. Make sure your answer is clearly marked. Ambiguous responses will be marked wrong.

1. Researchers summarized the results of a randomized comparative experiment with two doses of fremanezumab and a placebo. Patients with chronic migraine were randomly assigned to one of three treatment groups:

1. Group 1: Receive fremanezumab quarterly
2. Group 2: Receive fremanezumab monthly
3. Group 3: Receive placebo.

Why is it so critical to use **randomization** when assigning subjects to one of the three treatment groups?

(a) We want to create three groups of subjects which are similar on average at the beginning of the experiment.
(b) We want to guarantee the results from the experiment will be statistically significant.
(c) We want to remove all lurking variables.
(d) We want to ensure all subjects are treated equally during the course of the experiment.

2. When we use the sample proportion $\widehat{p}$ to estimate the population proportion p, we learned $\widehat{p}$ was unbiased if the sampling design was a simple random sample. What does it mean for a statistic to be **unbiased**?

(a) Its value will be the same in every possible sample.
(b) Its margin of error is 0.
(c) It neither systematically overestimates nor underestimates the population parameter on average.
(d) A histogram showing different values of the statistic will be symmetric in shape.

3. A sociologist at USC is interested in determining what proportion of 12th graders believe the drinking age should be lowered to 18 years. She randomly selects 5 high schools from the Columbia area and then interviews every 12th grade student in the schools that were selected. What type of sampling design is this?

(a) a systematic random sample
(b) a simple random sample
(c) a voluntary response sample
(d) a cluster sample

4. Researchers in Australia recruited 58 adults with diabetes for a study. These subjects were randomly assigned to one of two groups:

- **Group 1:** A low-modified-fat diet
- **Group 2:** A low-modified-fat diet that included a handful of walnuts each day.

After six months, researchers compared changes in HDL cholesterol levels for the two groups.

Is this an experiment or an observational study?

(a) experiment
(b) observational study

5. Refer to Question 4. After analyzing the data when the study concluded, researchers did **not** find a statistically significant difference between the average change in HDL cholesterol levels for the two groups.

This means the difference between the average change in HDL cholesterol levels for the two groups

(a) was decreased because the study included only adults with diabetes.
(b) was increased due to the use of randomization.
(c) was large enough so that a causal relationship between walnuts and HDL cholesterol levels is supported by the data.
(d) could be explained by random chance.

6. In July 2018, *Green Car Reports* conducted a Twitter poll and asked their readers,

Will the Tesla Roadster be the first classic electric car?

Of the 466 people who chose to take the poll, 48% answered "Yes" to this question. Why is the margin of error calculation

$$\frac{1}{\sqrt{466}} \approx \frac{1}{21.59} \approx 0.05$$

not useful in this example?

(a) The sample size is too small to provide a statistically significant result.
(b) *Green Car Reports* is attempting to take a census.
(c) The question is not worded clearly, for example, it is not clear what "classic" means.
(d) The respondents are not a simple random sample.

7. An experiment was performed to determine if drinking coffee was effective at reducing blood alcohol content. There were 30 subjects in the experiment (18 men and 12 women) and each subject's weight was recorded (in lbs). There are two variables in this example: sex and weight. What types of variables are these?

(a) sex is categorical and weight is quantitative
(b) both variables are categorical
(c) sex is quantitative and weight is categorical
(d) both variables are quantitative

8. A large study used past records from Canada's national health care system to compare the effectiveness of two approaches to treat prostate cancer:

- Approach 1: Traditional surgery
- Approach 2: Radiation without surgery.

Investigators obtained records for thousands of past patients whose doctors had selected one approach or the other. The study found patients treated using Approach 2 were more likely to die within 10 years.

Is this an experiment or an observational study?

(a) Observational study. Investigators merely observed records from the past. Patients were not randomized to one of the two approaches.
(b) Experiment. The study included two groups, and the investigators were interested in comparing the groups.
(c) Experiment. The "more likely" conclusion references a statistically significant result, which is only possible to determine in an experiment.
(d) Observational study. The study aimed to determine a causal link between the approach to treat patients and 10-year survival with a large number of patients.

9. A university committee has 5 students on it. The Student Body President wants to select a simple random sample of 2 students from this committee to serve on a special panel. How many samples of 2 students are possible?

(a) 25
(b) 5
(c) 2
(d) 10

10. A university has 30,000 undergraduate students and 10,000 graduate students. A survey of student opinion concerning health care access selects 300 of the 30,000 undergraduate students at random and then separately selects 100 of the 10,000 graduate students at random.

Which of the following statements is (are) correct?

I. Each student has the same chance of being selected.

II. The 400 students selected is a simple random sample.

(a) Both statements are correct.
(b) Statement II is correct, but statement I is incorrect.
(c) Statement I is correct, but statement II is incorrect.
(d) Both statements are incorrect.

11. Which statement is correct?

(a) We use population parameters to estimate sample statistics.
(b) We use population statistics to estimate sample parameters.
(c) We use sample parameters to estimate population statistics.
(d) We use sample statistics to estimate population parameters.

12. There are 185 students enrolled in my section of STAT 110 this semester. I would like to get feedback from my students on whether they are satisfied with the cost of the textbook they are required to purchase for the class. If I did this by getting responses from all 185 students in the class, this would be a

(a) census
(b) randomized comparative experiment
(c) double-blinded study
(d) randomized response survey

13. An online survey of college parents was conducted during February and March 2007. E-mails were sent to 41,000 individual parents who were listed in either the College Parents of America or the Student Advantage database. Of the 41,000 individuals who were invited to participate in the survey online, only 1,727 completed it. What was the **response rate**?

(a) 16.8%
(b) 2.1%
(c) 4.2%
(d) 8.4%

14. Gallup News Service conducted a sample survey during October 5-11, 2017 with 1,028 American adults (aged 18 and over), asking,

Are you in favor of the death penalty for a person convicted of murder?

Fifty-five (55%) of the 1,028 adults responded "Yes" to this question. In this example, what is the **sample**?

(a) all American adults
(b) all American adults in favor of the death penalty
(c) the 1,028 adults who responded to the question above
(d) the 55% who responded "Yes" to the question above

15. The **randomized-response technique** would be best suited for which of the following survey questions?

(a) Do you average at least 8 hours of sleep per night?
(b) Do you enjoy running as a means of cardiovascular exercise?
(c) Are you satisfied with the options for food purchase on campus at USC?
(d) Have you ever used illegal drugs?

16. The *American Journal of Clinical Nutrition* published a research study to investigate the effect of a diet rich in grains. Fifty (50) adults were assigned to one of two groups:

- **Group 1:** whole grains from brown rice, whole wheat bread, etc.
- **Group 2:** refined grains from white rice, white bread, etc.

Both groups lost weight at the end of a 12-week follow-up period. Group 1 subjects lost 11 lbs on average, while Group 2 subjects lost 8 lbs on average.

It was later determined that the heaviest subjects were assigned to Group 1 and the lightest subjects were assigned to Group 2. This invalidates the results of this experiment, because the effect of eating different types of grains is _____ with the weight of the subjects.

(a) randomized
(b) controlled
(c) replicated
(d) confounded

17. What is the defining feature of a **simple random sample**?

(a) It is the only sampling design that removes all random sampling error.
(b) The sample chosen is guaranteed to be representative of the population.
(c) Every sample of the same size has the same chance of being selected.
(d) All of the above.

18. What are the two primary parts of a **confidence statement**?

(a) margin of error and confidence level
(b) measurement and bias
(c) individuals and treatment
(d) replication and randomization

19. Rasmussen Reports conducted a national telephone and online survey using a sample of $n = 1009$ American adults. Each participant was asked,

Would you favor eliminating the Electoral College so that whoever wins a majority of the popular vote wins the presidential election?

Rasmussen reported for this survey a margin of error of $\pm 3\%$ assuming a 95% confidence level. Which non-sampling error is accounted for in the margin of error?

(a) interviewer bias
(b) giving untruthful responses
(c) non-response
(d) **none of the above**

20. Refer to Question 19. If Rasmussen used the same sampling design but increased the sample size to 10,090 American adults (a sample size 10 times larger), what would happen to the margin of error?

(a) it would increase
(b) it would stay the same
(c) **it would decrease**

21. In the language of randomized comparative experiments, what is a **treatment**?

(a) a formula that shows researchers how to calculate the margin of error
(b) a condition which is applied to the individuals
(c) a device which makes groups as balanced as possible through chance assignment
(d) an open-source simulation to determine if estimates will be unbiased

22. You want to investigate the attitudes of undergraduate students at USC toward the school's policy on charging extra fees in courses with lab components. Your plan is to sample 200 students as part of a sample survey (Columbia campus only).

There are 28,127 undergraduate students currently enrolled at USC's Columbia campus. A complete list of all 28,127 students is called a

(a) randomization device
(b) causal diagram
(c) probability match
(d) sampling frame

23. A randomized comparative experiment was performed with 864 subjects who were at risk for colon cancer. The subjects were randomly assigned to four vitamin supplement groups:

- **Group 1:** daily beta carotene
- **Group 2:** daily vitamins C and E
- **Group 3:** all three vitamins every day
- **Group 4:** daily placebo.

After four years, the researchers observed whether each subject had been diagnosed with colon cancer. In this experiment, what is the **response variable**?

(a) vitamin supplement group
(b) colon cancer diagnosis (yes/no)
(c) the four-year followup period
(d) the 864 subjects

24. The Current Population Survey is a monthly survey of households conducted by the Bureau of Labor Statistics. The July 2024 survey included a sample of 60,000 households (from the 127,000,000 households in the US) and reported an unemployment rate of 4.3%.

The 4.3% figure was determined from the sample of 60,000 households contacted. This makes 4.3% a

(a) parameter
(b) statistic

25. Before I wrote this question, I looked at my Rate My Professors web site profile. I observed that 58 students had given me ratings during the last 18 years for different courses I have taught at USC (over which time I have taught about 2,000 students). The collection of 58 students is best regarded as a

(a) voluntary response sample
(b) cluster sample
(c) simple random sample
(d) systematic random sample

PART 2: SHORT ANSWER. Give detailed responses. Please write clearly and legibly.

Rasmussen Reports recently conducted a national survey with a sample of 1,238 American adults. Each participant was asked:

> *Should children be required to say the Pledge of Allegiance every morning at school?*

The survey found that 681 of the 1238 adults in the sample answered "Yes" to this question.

(a) Calculate the sample proportion of adults who say children should be required to say the Pledge of Allegiance every morning at school.

Answer:

$$\widehat{p} = \frac{681}{1238} \approx 0.55 \quad (\text{or } 55\%).$$

(b) Rasmussen reports "the margin of sampling error is ±3% with a 95% level of confidence." If Rasmussen used a simple random sample, perform a calculation that shows where the "±3%" figure comes from.

Answer:

$$\textbf{margin of error} = \frac{1}{\sqrt{1238}} \approx \frac{1}{35.19} \approx 0.03 \quad (\text{or } 3\%).$$

(c) Write a 95% confidence statement. A confidence statement is a well-written sentence.

Answer: We are 95% confident the proportion of all American adults who say children should be required to say the Pledge of Allegiance every morning at school is between 0.52 and 0.58 (or 52% and 58%).

PART 3: EXTRA CREDIT. Give a detailed response. Please write clearly and legibly.

I asked you to read Judith Singer's paper, "Afraid to Discuss Evolution?," and we discussed this paper in class. The paper summarized a 2005 *New York Times* editorial. Summarize the findings of Singer's paper and our classroom discussion. In particular,

- state the topic discussed in the *New York Times* editorial
- state at least three things that led to Singer's attack of the editorial board's conclusions
- state "the take-home message" from our discussion.

Successfully addressing each of these topics will earn you full credit. Use clearly written and complete sentences.

Answer: The *New York Times* editorial was written about high school biology teachers in Louisiana. The claim made in the editorial was that a large percentage of them (41%) questioned the theory of evolution. The statistics cited in the editorial came from a 1998 PhD dissertation on teaching evolution and creationism.

Here are at least three things wrong with the study (on which the editorial was based):

1. The response rate was about 50 percent (non-response, non-sampling error)
2. The investigator was a known figure in Louisiana education circles and was known to be pro-evolution (interviewer bias, non-sampling error)
3. The questions were worded in a persuasive way (poorly worded questions, non-sampling error).

We should be skeptical about what we see and hear in the news! The editorial cited a "PhD doctoral dissertation" and hand-picked which statistics made its argument the strongest. This might sound convincing until you dig deeper and discover all the non-sampling errors that occurred in the survey.