Behavioral Research and Experiment Design (Monsoon'24)
Mid-Semester Examinations
Total Marks: 35
Time: 1.5 Hours

General Instructions:

- **Read all instructions and questions carefully before answering.**
- **Important**: If your answer involves assumptions, be sure to clarify them for a complete understanding of your answer.
- If you perceive a question as confusing or open to interpretation, you're allowed to make reasonable assumptions; please specify these in your answer.
- There can be multiple options correct for MCQs, where the marking will be done as follows:
  - ➢ Any wrong option marked - 0 marks
  - ➢ All correct options marked - 1 marks
  - ➢ Any other permutation combination - 0 marks

Section A: Multiple Choice Questions [1M each x 8 = 8 Marks]

1. In a factorial design, which of the following describes an "interaction effect"?
   a. The combined effect of two or more independent variables on the dependent variable
   b. The effect of a single independent variable on the dependent variable
   c. The overall difference between groups in a randomized control trial
   d. The difference between pre-test and post-test results in a single condition.

2. Which type of validity is concerned with whether a test measures what it is supposed to measure?
   a. External Validity
   b. Internal Validity
   c. Construct Validity
   d. Face Validity

3. Which of the following sampling methods is both probabilistic and leads to a skew due to bias caused by homogeneity between groups in a considered sample?
   a. Cluster Sampling
   b. Stratified Sampling
   c. Quota Sampling
   d. Snowball Sampling

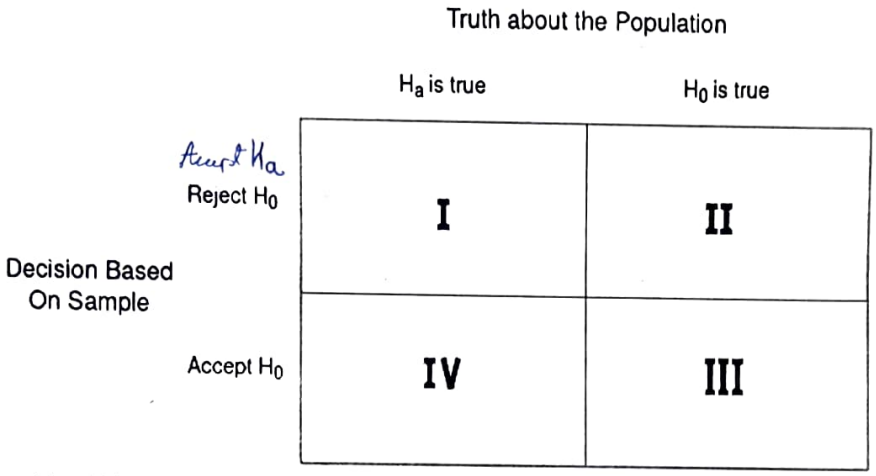
4. The following are statements regarding kinds of reliability.
   I. Inter-Rater and Intra-Rater reliability: Stability and degree of agreement between people during measurements.
   II. Test-retest reliability: Stability and consistency of method over time/repeated measurements.
   III. Internal Consistency: Coherence of attributes constituting the method.
   IV. Parallel Alternate Form: Equivalence of two versions of method to compare results.

   Which of the statements given above is/are correct?
   a. Only I and II are correct, III and IV are incorrect
   b. Only III and IV are correct, I and II are incorrect

c. Only II and IV are correct, I and III are incorrect
d. All of the above statements are correct

5. Which of the following is/are a characteristic feature of Item Analysis in the Item Response Theory?
   a. It provides a way of measuring the quality of questions and how appropriately they measured the ability/trait of the respondents.
   b. It enhances precision of measurement and enables adaptive testing with different sets of items.
   c. It provides a way to know how items will perform with different respondents beforehand.
   d. It allows the direct measurement of a respondent's ability without considering item parameters.

6. The following figure below presents a typical hypothesis testing confusion matrix showing the actual condition as the column and the predicted condition as the rows. Which of the following is false about the confusion matrix?



   a. Cell (I) corresponds to sensitivity, and Cell (III) corresponds to Specificity
   b. Cell (II) corresponds to sensitivity, and Cell (IV) corresponds to Specificity
   c. Cell (I) corresponds to Type I error, and Cell (III) corresponds to Type II error
   d. Cell (II) corresponds to Type I error, and Cell (IV) corresponds to Type II error

7. A non-profit and social initiative group wants to perform an experiment on corporate employees of an office post their work hours. However, they are concerned that the responses received and the researcher's interpretation of the responses/observations both might be affected due to fatigue after a long day. In other words, they are concerned about
   a. Participant Error
   b. Researcher Error
   c. Participant Bias
   d. Researcher Bias

8. Which of the following statements is true regarding levels of measurement?
   a. Amount of acceptable statistical methods decreases as the level of measurement increases.
   b. At least ordinal level data is needed to perform parametric statistical tests.
   c. Statistical methods used for higher levels of measurement cannot be applied to lower levels.
   d. Nominal -> Ordinal -> Interval -> Ratio is the increasing order of level of measurement.

Section B: Short Answer Questions [3M each x 5 = 15 Marks]

You're required to solve any five of the given eight question. If more than five questions are solved, the first five will be considered for evaluation.

1. Define a randomized controlled trial (RCT) and discuss the advantages of RCT design compared to other experimental methodologies in behavioural research.

2. What is the difference between internal and external validity in experimental research? Compare the levels of internal and external validity in lab experiments versus field experiments.

3. Discuss the mixed methods approach to data collection in research, highlighting the advantages of using surveys and questionnaires. Specifically, define what constitutes quantitative and qualitative data within this context.

4. A researcher is studying the impact of different teaching methods on student performance. They collect the following data: **[1 M each]**
   Teaching method used (Traditional, Flipped Classroom, Project-based)
   a. Student's final grade (0-100)
   b. Number of assignments completed (0-10)
   c. Student's satisfaction rating (Very Unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied)

   Identify the type of variable for each piece of data collected.

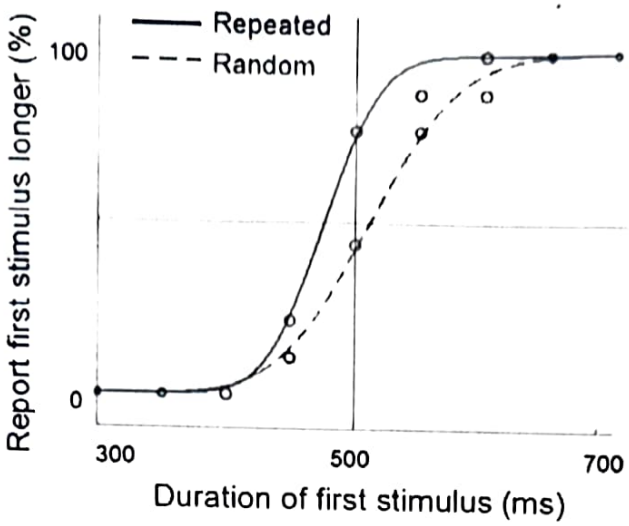
5. Differentiate between ordinal level of measurement and Interval level of measurement. (write two theoretical differences and an example)

6. How does differential privacy (DP) address privacy concerns in research involving large experience sampling datasets? Provide a real-world example where DP is applied.

7. In a study designed to measure the effect of a new educational technique on students' performance, participants were aware that they were part of an experiment to test "an innovative and superior teaching method." The teachers, who were also aware of the study's purpose, conducted the classes differently for the experimental group compared to the control group. After the study, it was found that the experimental group showed significantly higher performance.

   a. Identify and explain how demand characteristics could have influenced the results of this study.
   b. Describe what detection bias is and discuss how it might have been present in this experiment, particularly with reference to the role of the teachers.
   c. Propose two strategies that the researchers could implement to minimize the impact of demand characteristics and detection bias in future replications of this study.

8. A researcher is conducting a psychometric study to examine how people perceive the duration of the first stimulus in a sequence of stimuli under two different conditions: Repeated and Random. Participants were asked to judge whether the first stimulus in the sequence was shorter or longer than the other stimuli in the sequence. The following plot illustrates the results. What can we deduce from this psychometric plot regarding the point of subjective equality (PSE) and the bias in both the repeated and random conditions?



Section C: Long Descriptive Questions [5+7 = 12 Marks]

1. Explain the distinction between observing a difference and observing a correlation in behavioural studies. **[2M]**. Discuss the same in the following examples by identifying whether the studies represent an observation of difference or correlation. **[1M x 3 = 3M]**
   a. A longitudinal study tracks children's screen time and attention span over several years. Researchers find a consistent pattern: as screen time increases, attention span tends to decrease across different age groups and socioeconomic backgrounds.

   b. A research team conducts a controlled experiment comparing cognitive performance among three groups: those with high-quality sleep (8 hours of restful sleep), low-quality sleep (8 hours of disrupted sleep), and sleep deprivation (4 hours). They measure performance on tasks involving problem-solving, memory recall, and attention. The results show that the group with high-quality sleep performs significantly better than both the low-quality and sleep-deprived groups.

   c. An organizational psychology study examines data from multiple companies to assess the relationship between reported workplace stress levels and employee turnover rates. The findings indicate that higher levels of reported stress are associated with increased turnover rates.

2. Each of the following statements is from a conversation of students discussing their practical work and contains a reference to a form of validity threat. You're required to pick which validity threat it is (from - 'statistical conclusion', 'internal', 'construct' or 'external') for each of the statements below and justify your choice by stating or describing the threat. **[7M]**

   a. The questionnaire we used didn't measure anxiety; it measured stress instead.
   b. The experiment only worked because we used students from the psychology department.
   c. The difference between groups might have been due to chance because we didn't have enough participants.