

**MQM Comprehensive Examination  
Statistics Minor**

**Day 3**

**Directions:** On this exam you must answer four questions. The first two (in Part I) are required, and you must choose two from among the remaining four questions in Part II. Begin each response on a new page, and clearly number the questions to which you are responding.

**Part I. Answer both questions.**

1. Standard errors: The standard error is central to survey research. Assume you are to estimate the proportion of the United States adult population that believes the United States should sign the Kyoto agreement.
  - A. What factors would influence the standard error of this estimate?
  - B. How would you suggest that these factors be handled so as to obtain a more precise estimate of the proportion?
2. Multiple regression: Standardized regression coefficients, or “betas,” from a multiple regression model are sometimes preferred to as “raw” regression coefficients because the differences in their magnitudes indicate their relative importance in predicting the outcome variable.
  - A. Discuss how these two types of regression coefficients differ.
  - B. For each type, describe a context when that type would be preferable.

**Part II. Answer two of the following four questions.**

3. Analysis of Covariance (ANCOVA)
  - A. Using analysis of variance (ANOVA) as the frame of reference, discuss why analysis of covariance (ANCOVA) is a frequently used statistical technique.
  - B. Discuss ANCOVA’s primary role in both comparative quasi-experimental research studies and in experimental (randomized) research studies.
4. Hypothesis testing: Employing the following terms in your answer: sample sizes, standard errors, critical value, Type I error, and p-value, answer the following:
  - A. What is a test-statistic, and how is it helpful for making statistical inference?

- B. Explain its importance in a hypothetical example of a t-test of the equality of the means from two independent samples?
  
5. Effect size measures
  - A. Discuss the advantages and disadvantages of effect size measures.
  - B. Specify an effect size measure, being sure to define all your notation.
    - i. Describe what statistical model this effect size is appropriate for.
    - ii. Specify how you would interpret various values of this effect size measure.
  
6. Power: The power of a statistical test is an important consideration when designing research studies. Researchers not only have to be concerned with the probability of committing a Type I error, but also with the probability of finding a difference when it truly exists.
  - A. List and explain three factors that affect the power of a statistical test.
  - B. List two methods of determining the size of an effect you would expect to see from your own research study (a priori); address an advantage and disadvantage of each of the methods.
  - C. Suppose you were interested in detecting an effect that has been characterized as 'small' by Cohen's rule of thumb concerning effect sizes. Which of the factors you listed in part B would be the most critical for increasing the power of your test and why?