

MS Module 4: Hypotheses and Test Procedures (overview)

(The attached PDF file has better formatting.)

Reading: §9.1: Hypotheses and Test Procedures

Classical mathematical statistics deals with hypothesis testing and confidence intervals. Final exam problems combine these subjects with the scenarios covered in later modules.

The null hypothesis may be simple (that a parameter equals some value, such as zero) or complex (that the parameter is more or less than a value). The alternative hypothesis is the negation of the null hypothesis: that the parameter does not equal the value or that it is more than or less than the value.

Understand Type 1 and Type 2 errors: α denotes the probability of a Type I error and β denotes the probability of a Type II error. These probabilities depend on the rejection region, which depends on the type of null hypothesis and the confidence level. Final exam problems give either rejection regions or confidence levels to compute α . They give also the true value of the parameter to compute β .

For clarity, the textbook uses examples from a binomial distribution, so you can solve the arithmetic by pencil and paper. Most final exam problems use the normal distribution or a transformation of the normal distribution.

Confidence intervals and hypothesis testing have several forms:

- if the population is normally distributed with a known variance, use z values
- if the population is normally distributed with an unknown variance, use t values
 - if the sample is large, the t value approximates the z value
- if the population is not normally distributed but the sample is large, the central limit theorem gives an approximate solution using t values

Module 4, continued: Hypothesis testing of the mean

Reading: §9.2: Tests about a population mean

The textbook has three cases:

- Case 1: Normal distributions with known variance
- Case 2: Samples large enough that the central limit theorem gives a close approximation
- Case 3: Normal distributions with unknown variance and small samples, which use t tests

The first few sub-sections on hypothesis testing have step-by-step instructions, such as on pages 430-431. Once you master the material, you don't need detailed instructions, but they help you learn the procedures.

The textbook shows formulas for β (the probability of a Type II error) for each type of confidence interval, and formulas for the needed sample sizes (given α and β). These formulas are repeated (with slight changes) in many chapters, and they are used on final exam problems.