ØAMET4100 · Spring 2019
Worksheet 1B

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1 Estimation of the Population Mean

Exercise 1.1. (Stock & Watson, Review the Concepts 3.1) What is the difference between an unbiased estimator and a consistent estimator?

Exercise 1.2. (Stock & Watson, Review the Concepts 3.2) What is meant by the efficiency of an estimator? Which estimator is known as BLUE?

Exercise 1.3. (Stock & Watson, Review the Concepts 3.3) A population distribution has a mean of 15 and a variance of 10. Determine the mean and variance of $\overline{Y}$ from an i.i.d. sample from this population for (a) $n = 50$, (b) $n = 500$, (c) $n = 5000$. Relate your answer to the law of large numbers.

Exercise 1.4. (Stock & Watson, Review the Concepts 3.4) Differentiate between standard error and standard deviation. How is the standard error of a sample mean calculated?

2 Basic Concepts of Hypothesis Testing

Exercise 2.1. A company that stocks shelves in supermarkets is considering expanding the supply that it delivers. Items that are not sold must be discarded at the end of the day, so it only wants to schedule additional deliveries if stores regularly sell out. A break-even analysis indicates that an additional delivery cycle will be profitable if items are selling out in more than 60% of markets. A survey during the last week in 45 markets found the shelves bare in 35. Should the company add an additional delivery cycle?

(a) State the null and alternative hypothesis.

(b) Describe the Type I and Type II errors.

Exercise 2.2. Attempting to motivate customers to make early payment of their credit card bills, the manager of a credit card company implemented an experiment involving 200 of its customers. Half of these customers received a 2% discount for bills paid within 30 days of issuance of the bill, while the other half did not. Was the discount program effective in inducing clients to make early payments?

(a) State the null and alternative hypothesis.

(b) Describe the Type I and Type II errors.

3 Two-Sided Hypothesis Tests

Exercise 2.1. (Adapted from Stock & Watson, Exercise 3.13.) Data on fifth-grade test scores (reading and mathematics) for 420 school districts in California yield $\overline{Y} = 646.2$ and standard deviation $s_Y = 19.5$.

(a) At the 5% significance level, can we reject the hypothesis that the mean test score in the population is 650? Carry out the test using a t-statistic.

(b) Carry out the same test as in part (a) but using a p-value.

(c) Without doing any calculation, is 650 contained in the 95% confidence interval for the population mean test score? Explain why or why not.

(d) Calculate the 95% confidence interval for the mean test score in the population, and verify your answer in part (c).

When districts were divided into districts with small classes (< 20 students per teacher) and large classes (≥ 20 students per teacher), the following results were found:

Class Size	Ave. Score	Standard Deviation	n
Small	657.4	19.4	238
Large	650.0	17.9	182

(e) At the 10% significance level, can we reject the null hypothesis that the mean test scores across the two groups is equal? (For practice, solve this problem using t-statistic, p-value, and confidence interval).