Review Guide for Exam 2

March 20, 2000

Time and Place of Exam: The exam will be in class, on Tuesday, March 28.

Exam Materials: The exam is closed book. You can prepare a formula sheet: a standard-size sheet of paper on which you can write whatever you like, both sides. (As before, a simple formula sheet will be provided with the exam.) You will need a calculator.

Exam Coverage: Questions for the exam will be based on material in the sections of Chapters 6-9 which are detailed below:

Review: 4-5, 5-6, 5-8 (approximation to binomial).

Chapter 6:

* **Not covered:** Sections 6-2, 6-4, and 6-8.
* **Covered, but not on test:** 6-6.
* **Covered:** Sections 6-1, 6-3, 6-5, 6-7.

Chapter 7:

* **Not covered:** 7-3.4, 7-4.
* **Covered:** 7-1, 7-2, 7-3.1-7-3.3, 7-5, 7-6, 7-7.

Chapter 8:

* **Not covered:** 8-2.8, 8-3.4, 8-4, 8-5.2 (part on choosing n), 8-7, 8-8.
* **Covered:** Everything else.

Chapter 9:

* **Not covered:** 9-2.2, 9-3.2, 9-4 (will be on next exam), 9-5, 9-6.2 (part on choosing n),
* **Covered:** Everything else.

Review: For all of the hypothesis test and confidence interval examples that we've discussed so far, the population has been either normal or binomial. Make sure that you know the following:

1. Basic information about this two distributions: means, variances, when they are useful as models.
2. The central limit theorem and why it is important.
3. What it means to standardize a random variable, in particular a normal random variable.
4. The use of the normal distribution to approximate the binomial.
5. How to compute probabilities for normal random variables using standardization and the standard normal table.

- Bivariate Random Variables (Chapter 6)

  1. Discrete or continuous
  2. Probability mass function (discrete), probability density (continuous)
  3. Marginal distribution
  4. Conditional distribution
  5. Marginal mean, variance and standard deviation; conditional mean and standard deviation
  6. Covariance and correlation
  7. Independence, and the distinction between two random variables being independent vs. uncorrelated.
  8. The fact that a linear combination of normal random variables is normal, and what the mean and variance of such a linear combination is.

- **Random Sampling and Sampling Distributions (Chapter 7):** You should be familiar with the following concepts

1. Random sample
2. Statistic
3. Sampling distribution of a statistic
4. Point estimation
5. Central limit theorem
6. Bias, variance and mean square error of an estimator
7. The distinction between the standard deviation of an estimator (standard error), and the corresponding standard deviation of the population (think of the distribution of $\bar{X}$ for a sample from a normal population to clarify this point).
8. The concept of confidence interval, and the meaning of the term "confidence".

- **Hypothesis Testing: Basic Concepts (Chapter 8, sections 8-1 and 8-2, and the notes):** You should understand the logic behind the construction and use of hypothesis tests. The exam will be restricted to tests on means and proportions, for one and two samples, not including the paired t-test. The paired-sample t-test, which will be on the third exam. First make sure that you know these concepts. It's useful to think about them in terms of a one-sample test for a normal mean, variance known:

  1. Definition and meaning of a hypothesis test
  2. Null and alternative hypotheses
  3. Type I error (α, size, significance level)
  4. Type II error (β)
  5. Power, relationship to Type II error, how power depends on the parameter under the alternative hypothesis. Also, the qualitative relationship of power to sample size (thought you don't need to know the sample size formulas in the book).
  6. One-sided vs. two-sided tests
  7. Eight-step procedure
  8. Confidence intervals, and how they are related to hypothesis tests.

9. P-values. Know what they are, and that a P-value is *not* the probability that the null hypothesis is true!
10. Why statistical significance need not correspond to practical engineering importance

- **Hypothesis Testing: Specific Kinds of Hypothesis Tests (Remainder of material covered in Chapters 8 and 9, and notes):** Once you understand the basic ideas, and how to use them to construct and interpret a hypothesis test for a normal mean (single sample, variance known), then you should go over the following tests

  1. Single normal population, variance unknown

     Students-t distribution, degrees of freedom, use of table for this distribution.

  2. Two normal populations, variances known

     Distribution of a linear combination of normal random variables; standardization.

  3. Two normal populations, variances unknown but equal

     Pooled variance estimation, and its degrees of freedom

  4. Two normal populations, variances unknown and possibly unequal

     Degrees of freedom for t-distribution approximation.

  5. Single binomial population

     Estimation of a binomial parameter

     Normal approximation to the binomial distribution

  6. Two binomial populations

     Mean, variance, and standardization of a linear combination of (approximate) normal random variables.