Material Covered

Test 3 is cumulative but emphasizes Sections 3.7–4.5, and some linear algebra (Appendix C).

Note that there is a summary at the end of each chapter that briefly reviews the most important topics of the chapter. You should also check the errata page to make sure you have corrected any errors in your text.

Format

The exam will include both an in-class portion and a take-home portion. For the in-class portion, no notes are allowed, but I will provide you with the table on page 214.

In-class exam problems will be printed on paper without allowing room for your work. You will be given blank paper to do you work on. This allows you to use the amount of space you need for each problem, but requires that you do some things to help me out:

- Put your name on each sheet (just in case).
- Clearly label each problem, and leave some space between problems. Do not work in two columns.
- Leave margins around your work! I'll three-hole punch the paper to encourage you to leave a margin the left side. Make sure you also begin far enough down that page that the staple doesn't make part of you work impossible to read.
- You may put more than one problem on a page, but your work must be in order at the end. Don't start new problems on the bottom quarter of the page.

Things you should be sure to know

1. basics of random variables (continuous and discrete, including jointly distributed random variables)
   (a) pmfs, pdfs, cdfs, probability and quantile calculations
   (b) how and why to use the cdf method
   (c) mean, expected value, variance, covariance (including how to use `integrate()` and `sum()` as needed)
   (d) conditional and marginal distributions, independence
2. favorite distributions (continuous and discrete, see page 214 plus the chi-squared distributions)
   (a) situtations where they are (or might be) good models
   (b) R functions: `dnorm()`, `pnorm()`, `qnorm()`, `rnorm()`, etc.
3. moment generating functions
   (a) uniqueness and distribution recognition
   (b) relationship to linear transformations of random variables
   (c) mgf's for sums of independent random variables
   (d) use in proof of central limit theorem
4. estimators and sampling distributions
   (a) lingo and notation (estimator, estimate, and estimand)
   (b) unbiased estimators
   (c) favorite estimators ($\hat{\mu} = \overline{X}$, $\hat{\sigma}^2 = S^2$, $\hat{\pi} = \frac{X}{n}$) and their sampling distributions under various conditions

5. inference based on normal distributions
   (a) simple random sampling and iid random sampling
   (b) Central Limit Theorem
      - statement
      - importance
      - use to obtain other limit theorems (e.g., binomial is approximately normal under certain conditions)
   (c) confidence intervals (confidence level, coverage rate)
   (d) `prop.test()` vs. `binom.test()`

Some Additional Comments

- Be sure to look over your old homework so you can fix any problems detected there.
- No mystery numbers allowed. It should be clear where every number comes from.
   - If you use a calculator or computer to get a number, it must be clear from the work on your paper how someone else could get that number. (Write down the R code, for example.)
   - When doing combinatorics problems, make it clear where the component numbers are coming from.
   - Round as late as possible. Keep three significant digits. (Leading 0's are not significant digits.)
- Use notation well.
   - You are required to understand and use the notation we have introduced in class. This includes correct use of the equals sign (=).
   - If you received a "notation" comment on a problem set, be sure you understand it.
   - You may invent notation as long as you explain it.
- Don't be afraid to use words.

  In any case, do your work in "paragraph order" (left to right, top to bottom).
- When doing probability problems be sure to identify the events and random variables involved.

  For working with random variables, for example, it is often good to have statements like each of the following exaples as part of your solution:
   - Let $X =$ the time until the next customer arives.
     (Describe the random variable in words.)
   - Then $X \sim \mathsf{Exp}(\lambda = 20)$.
     (Specify the particular distribution of the random variable if it is one of our familiar examples.)
   - $P(X \geqslant 30) = 1 - P(X \leqslant 30) =$`1 - pexp(30,20)`
     (Identify the probability you are calculating and the R code used to get it.)

  A similar approach should be used for other probability problems as well. This approach will help you think clearly and avoid errors. It will also help me grade your work.