

Mathematics 376 – Probability and Statistics II
Review Sheet, Final Exam
April 30, 2004

General Information

The final examination for this course will be given at 2:30 a.m. on Wednesday, May 12 in our regular class room, Swords 302. The exam will be roughly twice the length of one of the midterms, but you will have the full three hour period from 2:30 pm to 5:30 pm to work on it if you need that much time. Like the midterms, this will be an open book, open notes exam. Even more so than on that exam, of course, it will be necessary to prepare carefully; you do not want to be flipping through the book for every formula you need or similar examples to help you get started on every problem. There will not be enough time to complete the exam if you are doing that.

Topics to be Covered

- 1) Sampling distributions related to the normal distribution (χ^2 , t , F distributions) – know how to tell when a random variable has one of these distributions, how to use the tables for each in the text, etc.
- 2) the Central Limit Theorem, and the moment-generating function technique we used to prove it
- 3) The normal approximation to binomial distributions
- 4) Point estimators for distribution parameters, bias, mean square error, standard error. Be sure you understand Table 8.1 on page 371 of the text, where all the entries come from, and how they are used. Also be able to analyze estimators to determine whether they are biased or not, construct unbiased estimators, etc. (see Problem Set 3).
- 5) The pdf's for order statistics (especially the sample maximum and minimum), and how they can be used for estimation problems, especially in conjunction with:
- 6) The method of moments and the method of maximum likelihood for deriving estimators. (The other material we discussed in Chapter 9 on consistency of estimators, sufficient statistics, etc. will not appear on the exam.)
- 7) Hypothesis testing – the general concepts: null hypothesis, alternative hypothesis, test statistic, rejection region, Type I error probability ($= \alpha$, or level of test), Type II error probability ($= \beta$), attained significance level (p -value of a test), interpretation of results.
- 8) The connection between confidence intervals and rejection/“acceptance” regions for tests.
- 9) Large sample (Z -) tests and related confidence intervals for means and proportions. Questions here might also ask you to design tests with a given α -value to achieve a certain β -value by selecting sample size appropriately.
- 10) Small sample (t -) tests for means and related confidence intervals.
- 11) χ^2 -tests for variances and related confidence intervals.
- 12) F -tests for ratios of variances and related confidence intervals.

- 13) Simple linear regression for linear models of the form $Y = \beta_0 + \beta_1 x + \epsilon$. Be prepared to compute the least squares estimators for the coefficients β_i in a “small” example (say $n \leq 10$ or so) with a calculator (Maple will not be available!). Also know how to carry out hypothesis tests on the β_i of the types we considered in class (see sections 11.5 and 6). (The material on multiple regression, ANOVA for testing linearity of regression, etc. that we saw in Lab Project 4 *will not be covered* on the final.)

Suggestions on How to Study

Start by reading the above list of topics carefully. If there are terms there that are unfamiliar or for which you cannot give the precise definition review them. Reread the class notes. *Everything on the final will be similar to something we have discussed at some point this semester.* Also look back over your graded problem sets and exams. If there are problems that you did not get the first time around, try them again now. Then go through the suggested problems from the review sheets. If you have worked these out previously, it is not necessary to do them all again. But try a representative sample “from scratch”. Don’t just look over your old solutions and nod your head if it looks familiar. Practice thinking through the logic of how the solution is derived again.

Suggested Review Problems

Look at the problems from the two previous review sheets for the topics 1 - 12 above. For the last one (regression and hypotheses concerning the regression coefficients): From Chapter 11/4, 14, 29, 51 (“linearize the model” means to take the logarithm of both sides of $E(Y) = \alpha_0 e^{-\alpha_1 x}$ as $\ln(E(Y)) = \ln(\alpha_0) - \alpha_1 x$ and do the regression with the data points $(x_i, \ln(y_i))$ to estimate $\beta_0 = \ln(\alpha_0)$ and $\beta_1 = -\alpha_1$), 73ab, 74.

Review Session

I will be happy to run a review session for the final exam during study week. We can discuss a time in class.