The topics and questions given here are meant as a guide to help you study for Exam II, which will be on Thursday, November 21, 2019. The actual exam may include some problems that are more difficult (and some that are easier). See the chapter summaries and supplementary problems in the Rice textbook as well.

The exam will include a number of exercises that are similar to homework problems. You should review lecture notes, readings, and homework exercises and make sure you understand how to solve the problems from your homeworks. Note that Exam 2 will be a little more focused on concepts compared to Exam 1.

How to use this guide:

a) Look through each of the suggested problems and make sure you understand what the problem is asking.

b) If you see a problem that seems confusing or difficult, try to do it first. Please note that solutions to the suggested problems (listed below) will NOT be posted; some of the problems have answers in the back of the text, which you can use to check your work.

c) Go through the Chapter Review sections of Chapters 8, 9, 11 and 12 (although not all of any of these chapters will be covered; see my announcement from November TODO or see below for more information), and make sure you understand the definitions and key concepts. Note that while the focus of this exam is the material covered since our previous exam, a working knowledge of the material covered since the beginning of the semester is assumed.

d) Review homework problems carefully.

e) Focus on how particular important results are derived and make sure you understand the underlying process and concepts, rather than simply memorizing formulas.

f) Make up your own cheat sheet of key facts, formula, etc. You will not be allowed to use this cheat sheet in the exam, but the mere process of making it is one of the best things you can do to organize your thoughts.

TOPICS AND SUGGESTED EXERCISES

Topic/Chapter: [Rice, Chapter 8, Sections 8.5–8.8: Sufficiency, efficiency and the Cramer-Rao lower bound, Bayesian estimation and the relationship between Bayesian estimates and MLEs]

(a) Bayesian approach to parametric estimation; posteriors and priors; likelihood

(b) Conjugate families

(c) Comparing Bayesian estimates and classical MLEs

(d) Sufficiency and factorization; properties of sufficient statistics
Please keep in mind that while the focus here will be on the latter part of Chapter 8, the material is inherently cumulative, and thus questions may also be related to the first half of Chapter 8.

Suggested problems (look also at the assigned homework problems): Rice, Chapter 8, Exercise 4, 5(d), 6(b), 7(d), 17(d), 18(d), 60, 62, 63, 68.

**Topic/Chapter:** [Rice, Chapter 9, Sections 9.1–9.4: Hypothesis testing; Neyman-Pearson framework and Bayesian approaches]

(a) Hypothesis tests: null and alternative hypotheses. Type I and Type II error

(b) Likelihood ratio tests

(c) Neyman-Pearson Lemma; uniformly most powerful tests

(d) Confidence intervals and hypothesis tests; p-values

(e) Computing power

(f) Generalized likelihood ratio tests and how to compute GLRTs; Wilks’ Theorem about the asymptotic distribution of the logarithm of a GLRT

(g) Bayesian framework for hypothesis testing

Suggested problems (look also at the assigned homework problems): Rice, Chapter 9, Exercises 3, 4, 6, 8, 12, 13, 14, 15, 19, 20, 21, 23, 28, 32.

**Topic/Chapter:** [Rice, Chapter 11, Sections 11.1–11.3: Comparing two samples]

(a) Two-sample tests of hypothesis with independent samples

(b) Chi-squared and t-distributions

(c) Independence of $\bar{X}$ and $s^2$ for an i.i.d normal sample

(d) Two-sample t-test and its relationship to a generalized likelihood ratio test

(e) Computing power

Suggested problems (look also at the assigned homework problems): Rice, Chapter 11, Exercises 5, 10, 11, 13, and 14.

**Topic/Chapter:** [Rice, Chapter 12, Sections 12.1–12.2: Analysis of Variance and the One-Way Layout]

(a) The one-way layout and its independence assumptions

(b) Effect sizes

(c) The $F$-test and its assumptions, decomposition of the sum of squares into “within” and “between” terms

(d) $F$-statistic as a chi-square random variable

(e) Multiple comparisons; the Bonferroni correction and Tukey’s studentized range distribution.

Suggested problems (look also at the assigned homework problems): Rice, Chapter 12, Exercises 3, 4, 5 and 6.