Revision and Final Examination

December 2020

General information:

- The final examination consists of 6 problem-solving questions.
- Attempt all questions.
- The exam is open-book in the sense that hard copies of any materials are allowed.
- Calculators in compliance of the university regulations are allowed and needed.
- Show the details of your work leading to the answers.
- The marks for each question and its parts are shown in the brackets.
- Follow the Lecture Notes for any symbol that is not specified in the exam.
- Selected formulae and critical points are provided after the end of questions.
- As a sample of exam questions, the final exam in 2019 will be posted at the end of Week 13. Its solution will be provided in Week 14 to assist revision and preparation for the final exam in 2020.

Principles and tips:

- Understanding the concepts, definitions, formulae and methodology is the key to good performance.
- The ability and experience to deal with variations of the problems are crucial to get the answers correctly and efficiently.
- Make sure to show clearly the methods and steps leading to your answers. If you can demonstrate that you know how to solve the problems with correct methods, you will get appropriate credit.
- Proper steps and reasons to justify the answers are necessary to obtain full mark for problem-solving questions.
- If you see some ambiguity in a question, clearly state any assumptions you make in solving the problem. If your assumptions make sense, that will be recognized even if they deviate from the original intention of the question.
- The following order on the importance of questions for revision is suggested:

  1st (most important): Examples in the lectures;

  2nd: Questions of Assignments 1 and 2;

  3rd: Questions of Exercises and samples;

  4th: Other questions for practice.

- Solutions to exam questions are generally of reasonable lengths and complexity. If the process looks too long and complicated, think it over carefully before spending too much time on technical parts.
- Do not spend too much time on numerical calculations, especially if time is tight. As long as the method and formulae used are correct, a miscalculation would only cost a small portion of marks.

Review of topics:

Note: The questions suggested below for review are just some examples. To prepare for the final exam, you should carefully review all concepts, theory and methods, questions and examples discussed and practiced throughout the semester.

- Background and concepts of statistics: Sample space and probability; continuous and discrete distributions; symmetric distributions; mean, median and variance; equally likely outcomes; combinatorial probability by enumeration; principles and logics of hypothesis testing; parametric and nonparametric methods.

  Review: Q1–4 of Assignment 1; Q1–3 of Assignment 2.

- One-sample location problem: Location family and parameter; treatment effects; sign test and Wilcoxon signed rank test; the exact and approximate distributions of the signed rank statistic; estimation of median based on signs and signed ranks.

  Review: Q2,3,6 of Assignment 1.

- Two-sample location problem: Location-shift model; Wilcoxon rank sum test of the treatment effect; the exact and approximate distributions of the rank sum statistic; Mann-Whitney statistic; estimation of the location-shift.

  Review: Q4,7,8 of Assignment 1; Q2 of 2019 Final Exam.

- Two-sample dispersion and other problems: Comparing variability between two samples; the location-scale parameter model; the Ansari-Bradley and Miller's Jackknife tests of dispersion; Lepage rank test for either location or dispersion; the Kolmogorov-Smirnov test of general differences in two populations.

  Review: Q4,7,8 of Assignment 1; Q4 of Assignment 2; Q2 of 2019 Final Exam.

- One-way layout: Testing equal treatment effects; Kruskal-Wallis test for general alternatives; Jonckheere-Terpstra test for ordered alternatives; Mack-Wolfe tests for umbrella alternatives; test of treatments versus a control; multiple comparisons; estimation of contrasts; simultaneous confidence intervals.

  Review: Q1,2,5 of Assignment 2; Q3 of 2019 Final Exam.

- Two-way layout: Treatments and blocks; randomized complete block design; tests for general and ordered alternatives; multiple comparisons; estimation of contrasts; tests and multiple comparisons in balanced incomplete block design (BIBD); arbitrary incomplete block design; block design with replications.

  Review: Q3,6 of Assignment 2; Q4 of 2019 Final Exam.

- Independence problem: Independence versus correlations; Kendall correlation coefficient; Kendall test of independence based on signs; exact and approximate distributions of the Kendall statistic; the estimate and confidence interval of the Kendall correlation coefficient; rank tests of independence based on the Spearman rank correlation coefficient.

  Review: Q5 of 2019 Final Exam.

- Regression problems: Linear regression models; Theil test of the slope; estimate and confidence interval of the slope; estimate of the intercept; Sen-Adichie test of equal slopes between regression lines; multiple linear regression.

  Review: Q6 of 2019 Final Exam; Example 8.4 of Lecture Notes.