a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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STAT 461/561, Statistical Inference II
2019/2020, Term 2
Instructor: Professor Jiahua Chen

Time and Place: M/W/F, 11:00-12:00 AM, ESB 4192

Description: Detailed development of the theory of testing hypotheses and confidence regions, Bayesian models and inference, elements of decision theory and additional topics. Any contemporary topics we come up with (e.g. Bootstrap, FDR, Lasso, Empirical likelihood). Intended for honours students and graduate students.

Prerequisites: Stat 460/560, Math 320. Stat 305 is recommended.

Textbook/course material: Lecture notes will be posted online

References:
Cox and Hinkley (1974). Theoretical Statistics. Chapman and Hall.
J. Shao (1998). Mathematical Statistics. Springer-Verlag.
E.L. Lehmann (1983) Theory of Point Estimation. Wiley/Wadsworth.

Website: canvas will be utilized.

Assessment: There will be one in-class midterm and one regular final exam. We aim to give up to 50 assignment problems for the whole semester (reduction for undergraduate students in Stat 461). A selective subset of them will be marked.

Deadlines will be posted and strictly observed! The course work will be heavier initially but more relaxed later. The load will be lower compared to previous terms.

Please do not use pencil. Use regular lined papers and write in double space. Start a new page when you start a new problem. Skip two lines when you start a new part of a problem. Explain your steps to ensure that the TA and/or myself can understand your logic. You are also welcome to submit your solutions in latex. Use large fonts and double line format.

Marking will emphasize the logical flow in addition to the correctness. A smooth answer with generally correct answer is sufficient for a mark of 5. Correct answers alone are worth a mark of 4. Illogical answers, or failing to hand in assignment problems, will result in a loss of all 5 marks. The marks for lengthy questions may be worth multiples of 5 marks.

The TA will be instructed to provide as much feedback as possible. Do ask the instructor if you do not understand or agree with his or her judgments.

Evaluation: 30% assignment + 40% midterm + 50% final exam – 20% of the worst of midterm/final. Midterm problems will be variations of assignment problems. If the grade of the

final exam is below 50\%, then the final grade will be 20% assignment + 40% midterm + 50% final exam.

Topics: Will be very brief on the first 3 topics devoted to technical and conceptual issues. May not be able to cover all later topics listed.

1. General discussion: Discipline of Statistics, Probability and Statistics model, Statistical inference. Point estimation.
2. Statistical significance test: Null hypothesis, Alternative hypothesis, Pure significance test, General notion of statistical significance test.
3. Optimality discussions on hypothesis tests: Neyman-Pearson Lemma, Uniformly most powerful for one-sided alternative, Monotone likelihood ratio, Existence of UMPU tests, Locally most powerful test.
4. Likelihood based hypothesis test: Consistency of MLE for one-dimensional θ and as a local maximum, Likelihood ratio test, Score test, Wald test.
5. Inferences for data with normal distribution: One-sample problem, Test for equal variance, Test for equal mean under equal variance assumption.
6. Non-parametric test: One-sample sign test. Two-sample permutation test, Wilcoxon two-sample rank test, Kolmogorov-Smirnov and Cramér-von Mises tests.
7. Confidence intervals or confidence regions: Confidence interval via hypothesis test, Confidence interval via pivotal quantities, Likelihood intervals, Prediction intervals.
8. Empirical likelihood: Likelihood ratio function and profile likelihood, Numerical problem, Hypothesis test and confidence region, adjusted empirical likelihood.
9. Resampling: Estimating Variance estimation, Estimating cumulative distribution function, Bootstrap Confidence Intervals.
10. Multiple comparison: Analysis of variance for one-way layout, The Bonferroni Method, Tukey Method.
11. False discovery rate, regularization methods such as Lasso and Scad.
12. Variable/Model selection problem: Bayesian information criterion, Consistency of BIC, Extended BIC.