# SYLLABUS

**FSRM 16:954:581**
**Probability and Statistical Inferences**

Fall, 2019

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| Instructor: | Professor Rong Chen<br>Office: Hill Center 580<br>Tel: (848) 445-7690<br>email address: rongchen@stat.rutgers.edu<br>Office Hours: Wednesday 3:00-5:00 or by appointment |
| TA: | TBD |
| Course Web Site: | *http://stat.rutgers.edu/~rongchen/ProbStat_Course19.html* |
| Prerequisite: | Level IV Statistics (e.g. Statistics 960:401 or 960:484)<br>It should be emphasized that this course will cover a great deal of material at a rapid pace and will involve a lot of mathematics. Students who have had difficulty in previous mathematics, probability and statistics courses may find that this course requires a considerable amount of time and effort, and should plan accordingly. |
| Text: | *All of Statistics: A Concise Course in Statistical Inference*, by Larry A. Wasserman<br><br>[Supplemental Text] *Pattern Recognition and Machine Learning*, by Christopher M. Bishop.<br><br>Note: Not all topics and chapters in the books will be covered. There will be supplemental materials outside the books. Lecture notes will be posted on the course web site. |
| Lectures: | Wednesday 6:40-9:30, Core 101 BUS |
| Grading: | Homework 35%<br>Midterm Exam 30%<br>Final Exam 35% |
| Schedule: | Midterm: Wednesday, Oct 16 (in class)<br>Final: Wednesday, Dec 14 (tentative)<br>No Class: Wednesday, Nov 27 |

**Homework:**

- Homework will be assigned and collected regularly. **Late homework will not be accepted. DO NOT COPY from other sources. Electronic copy is not accepted**.
- All homework assignment must be written on standard 8.5 by 11 paper and stapled together. Computer generated output without detailed explanations and remarks will not receive any credit. Only hard copies are accepted, except under special circumstances.
- Homework solutions will be available on our course web site.

**Course outline (tentative):**

0. **Introduction**
1. **Probability, Conditional probability, Independence**
2. **Random variables and distributions.**
3. **Expectation and variance, Conditional expectation**
4. **Decision theory. Minimizing expected loss, loss functions, classification, prediction. Bayes rules and Bayesian inference.**
5. **Probability inequalities: Chebyshev's inequality, Chernoff inequality and the law of large numbers.**
6. **Moment generating functions and the central limit theorem. Relationship to statistical inference.**
7. **Point and interval estimation. Methods for constructing estimators: Method-of-moments and maximum likelihood. Asymptotic results: Consistency and asymptotic normality.**
8. **Hypothesis testing, multiple testing and false discovery rates. Type I and type II error, power. Familywise error rate and false discovery rate. Benjamini-Hochberg procedure.**
9. **Linear methods for regression and classification. Regression: Least-squares, bias-variance decomposition, Bayesian linear regression, Classification, Linear discriminant.**
10. (if time permits) **Non-linear methods for regression and classification. Kernel density estimators and nearest-neighbor classifiers.**