Math 4320 Fall 2017: Exam 3 Review
Professor William Ott

Exam 3 will cover the material in Sections 5.1, 5.3–5.5, 6.1, and 8.1–8.2 of *An Introduction to Stochastic Modeling* (Edition 4) by Pinsky and Karlin. Possible exercise types include true/false questions, statements of definitions and major results, computational exercises, and exercises requiring theoretical arguments. At least one of the exercises from Section 6 and at least one of the theoretical arguments in Section 5 will appear on Exam 3.

1. Definitions

You should be able to define and use the following.

(1) Poisson process, nonhomogeneous Poisson process
(2) Cox process
(3) Waiting times, inter-arrival (sojourn) times [associated with Poisson processes]
(4) Spatial Poisson process (see pg. 260)
(5) Brownian motion, standard Brownian motion
(6) Maximum variable associated with Brownian motion (see pg. 407)

2. Distributions

(1) Discrete distributions: Bernoulli, binomial, geometric, Poisson
(2) Continuous distributions: uniform, exponential, normal

3. Techniques

(1) Law of total probability
(2) Conditioning
(3) Solve problems involving Poisson processes, nonhomogeneous Poisson processes, and Cox processes
(4) Solve problems involving spatial Poisson processes
(5) Solve problems involving Brownian motion
(6) Applications of the reflection principle: Zeros of Brownian motion, time to first reach a level

4. Theoretical results

You should know and be able to apply the following.

(1) Theorems 5.1 and 5.2 (basic facts about the Poisson distribution)
(2) Theorems 5.4, 5.5, and 5.6 (distributions associated with the Poisson process)
(3) Theorem 5.7 (a link between the Poisson process and the uniform distribution)
(4) Link between spatial Poisson processes and the uniform distribution (see pg. 261)
(5) Variances and covariances associated with Brownian motion
(6) Reflection principle

5. Proofs/derivations

(1) Given a Poisson process with rate parameter $\lambda > 0$, show that the first two inter-arrival times are independent random variables, each exponentially distributed with mean $\frac{1}{\lambda}$.
(2) Theorem 5.7 (only the case $n = 1$)

6. Suggested problems

Please study the solutions to the exercises and problems that have been taken from the relevant sections of our textbook. Focus on the exercises that are not too long for an exam setting and on the problems that are not too difficult for an exam setting.