Midterm Exam Review: MATH 209, Spring 2024

Here is a summary of topics and outline of expectations for the upcoming midterm exam. Study slides, notes, and your homework. You may bring one 8.5 by 11 inch page of hand-written notes (writing on both front and back is okay) to the exam. Sections up to and including 4.3 ($M/M/c$ queueing model) are relevant:
https://web.math.rochester.edu/courses/current/209/schedule/
however, we will narrow the focus quite a bit below. Here are some helpful comments:

- Section 1.1 is not particularly relevant to the exam, other than having a workable knowledge of conditional probability and conditional expectation, as applied in queueing theory and HW 7 for instance. There are no questions on the exam similar to those in HW 1, however.
- Section 1.2 is not particularly relevant for the exam, but you should be very familiar with the exponential, Poisson, Erlang, and normal distributions (how they are related, their densities, cumulative functions, means, variances).
- There may be questions related to section 1.3. HW 2 is relevant. You should have a very good understanding of the Poisson process; understand how the number of arrivals on disjoint intervals correspond to Poisson variables, that interarrival times are independent exponential variables, and arrival times are Erlang variables (which are sums of independent exponential variables).
- There may be questions involving the newsvendor model and the newsvendor cost expression as seen in section 1.4. HW 3 P1-P3 and HW 4 P1 are highly relevant. There are no questions similar to HW 6, P3 however.
- You should have a good understanding of Little's Law (when it applies, what it says). However, there are no questions on the exam similar to HW 4 P2.
- There are no questions on the exam similar to HW4 P3.
- Study problem P4 on HW 4. It is highly relevant for the exam.
- Given a general description of a Markov chain, be able to write a transition matrix P and interpret results. Understand the relevance of the matrix P^n in determining the state distribution at time n. See HW4 P5-P6.
- When it exists, be able to find the limiting distribution in a Markov chain, and interpret it in terms of an application. See HW5 P1-P2.
- Be able to decompose states of a Markov chain into communication classes. Be able to classify states as recurrent or transient, and understand the relevance. See HW5 P1-P3.
- Be able to formulate a Markovian decision problem in a given application. Be able to setup and solve a decision LOP. See HW6 P1-P2.
- Understand the basic notation and assumptions of each model:
$M/M/1, M/M/1/K, M/M/c$.

- You will not be asked anything similar to HW 7 P1.
- Given steady-state probabilities p_n, be able to answer questions and interpret results in application. Be able to solve for basic performance measures L, L_q, W, W_q, taking advantage of Little's law when applicable. See HW7 P2-P3, P5.
- Understand the relevance of the PASTA principle and how it is invoked when asked about balking probabilities or similar. Study HW 7 P2(c)(d) and P4, they are highly relevant.