MATH 448 Bonus Homework 2, due Friday, October 4

Each of the following four problems can be completed for a 1% bonus applied to Exam 2, for a total of at most a bonus of 4%.

All of these problems concern a certain math professor, whose math exams each have 10 questions, a random number of which are taken directly from the homework, and the number of homework problems chosen for different exams are independent of each other. Each question is worth 10% of an exam's grade, and the questions are graded without partial credit, so each student either gets full credit or zero credit on each problem.

- In one semester, the professor states that the number of homework problems appearing on Exam 1 will be Poisson distributed with mean 1, the number of homework problems appearing on Exam 2 will be Poisson distributed with mean 2, and in general, the number of homework problems appearing on the kth exam will be Poisson distributed with mean k.

  1. If there are a total of five exams, what is the probability that there are exactly n homework problems used on the five exams in total? (Your answer will be in terms of n.)

  2. One student diligently studies the homework problems and is certain that she will get full credit on every exam problem that came from the homework. She estimates that there is a 50% chance that she will get full credit on any exam problem that did not come from the homework (independently of each other). What is the probability that she gets at least 7 out of the 10 questions correct on the kth exam? (Your answer will be in terms of k.)

- In another semester, the professor states that the number of homework problems appearing on each exam will always be Poisson distributed with mean 3.

  3. Consider again the student who is certain that she will get full credit on every exam problem that came from the homework and who estimates that there is a 50% chance that she will get full credit on any exam problem that did not come from the homework (independently of each other). What is the expected number of such exams that the student takes until the first time she gets at least 7 out of the 10 questions correct?

  4. Regardless of your answer to the previous question, there are a total of five exams in the semester, but the lowest exam score gets dropped. What is the probability that the student from the previous question gets at least 7 out of the 10 questions correct on at least 4 out of the 5 exams?