**1.** A conference organizer is planning a meal. There are 5200 attendees at the conference, but each person has a 20% chance of skipping the meal. (Assume that the people's behaviors are independent.)

**1a.** The number of attendees is a Binomial random variable. Write down an expression for the probability that at least 4200 people attend the meal. You do *not* need to calculate the probability itself.

**1b.** Use a Normal approximation to calculate the (approximate) probability that at least 4200 people attend the meal.

**2.** Consider a Gamma random variable with parameters $r = 1200$ and $\lambda = 1/3$. Approximate the probability that this Gamma random variable exceeds 3500. (Hint: This Gamma random variable has the same distribution as the sum of 1200 Exponential random variables, each with $\lambda = 1/3$.)

**3.** Suppose that the number of Roseate Spoonbills (a very rare bird in Indiana) that fly overhead in 1 hour has a Poisson distribution with mean 2. Also suppose that the number of Roseate Spoonbills is independent from hour to hour (e.g., the number of birds between noon and 1 PM does not affect the number of birds between 1 PM and 2 PM, etc.). Assume that a digital video camera tracks the sky overhead for 24 hours.

**3a.** Let $X$ denote the number of Roseate Spoonbills that fly overhead during that 24 hour period. What kind of distribution does $X$ actually have? What is/are the parameter(s)?

**3b.** Use a Normal random variable to approximate the probability that at least 45 Roseate Spoonbills fly overhead during that 24 hour period.

**4.** The Jelly Belly factory claims that it produces 1,250,000 beans *per hour*, on this website:
`http://news.jellybelly.com/brand-fact-sheet-jelly-belly-jelly-beans`

Suppose that the number of beans produced per hour is a Poisson random variable with mean 1,250,000. Therefore it is reasonable to assume that the number of beans produced in one minute is a Poisson random variable with mean 20833.33.

**4a.** Write down an exact formula for the probability that the number of jelly beans produced during the next 1 minute is between 20800 and 20900 (inclusive). You do not need to simplify or approximate this probability.

**4b.** Use a Normal approximation to estimate the probability that the number of jelly beans produced during the next 1 minute is between 20800 and 20900 (inclusive).