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Problem 3: “Thanks Susan” tweets (30 points + 1 bonus point)

In 2014 UConn witnessed the popularity of the Twitter feed [@ThanksSusan](#). (For the uninitiated, [Twitter](#) is a microblogging service where anyone can post messages, *a.k.a.* “tweets,” in 140 characters or less. Similar services are offered also by the likes of Facebook, Google+, and Sina Weibo.) In its few months of existence, the feed has morphed into a *de facto* complaint board for anything UConn, whether or not the complaints are directed toward Susan Herbst, the president of UConn.



Examples of tweets include:

‘8-12 inches of snow forecast for tomorrow. School still not cancelled. @ThanksSusan.’

‘@ThanksSusan These chicken nuggets served at McMahan. [Insert gross pictures of chicken nuggets.]’

‘Class average for the midterm was 45. @ThanksSusan.’

To a good approximation, we will model the number of tweets¹ arriving on the @ThanksSusan feed as a simple Poisson process with a rate of 20 per day. An analysis of the @ThanksSusan tweets since February shows that

- 40% of the tweets relate to *weather* (snow, school closings, not enough shoveling on sidewalks, etc.);
- 25% of the tweets relate to *academics* (complaints about classes, assignments, exams, professors, etc.);
- 20% of the tweets relate to dining hall *food* (bad oranges, hollow chicken nuggets, brown water, etc.);
- 10% of the tweets relate to *athletics* (men’s basketball losing to SMU twice, can’t get tickets to watch our basketball teams play in the Final Four, etc.);
- and 5% are *miscellaneous*.

¹Though not important for the problem, here tweets are interpreted broadly, which include direct tweets, retweets, and tweets containing the hashtag #ThanksSusan.

Please answer the following questions:

- (a) Give the rate at which tweets from each of the five categories (weather, academics, food, athletics, miscellaneous) arrive on the @ThanksSusan feed.

Over a period of two weeks:²

- (b) What is probability that there are exactly 200 *weather*-related tweets?
 (c) What is the mean number of *food*-related tweets?
 (d) What is the standard deviation in the number of *academics*- AND *athletics*-related tweets combined?
 (e) Given that there have been 200 weather-related tweets during the two weeks, what is the probability that 100 of these tweets arrived within the first 4 days?

Now consider the following scenario, however apocryphal it may sound. You have been hired by Susan Herbst to be her **ghostwriter** on Twitter. ('I am the real Susan!') Starting on April 7, you will be tasked to monitor the @ThanksSusan Twitter feed.

- (f) At noon on April 7, you turn on the computer and start monitoring the @ThanksSusan feed. What is the probability that the first *academics*-related tweet arrives on your monitor before the first *weather*-related tweet?
 (g) At 1 P.M. the 2nd *weather*-related tweet since noon appears on your monitor. Given this information, what is the expected time that the 5th *weather*-related tweet appears?

At 3 P.M. you receive a directive from Susan to start responding to the @ThanksSusan tweets. The instruction is as follows. The instant a tweet shows up on your monitor, you start to brainstorm and compose a "counter-tweet," then post it on the other tweeter's timeline. However, as a studious student, you have other (better?) things to tend to, and it will take you an average of 2 hours to complete a witty counter-tweet from scratch. By the time you finish, you may have missed a few more tweets, in which case you simply don't respond to them, and wait for the next tweet to arrive.

- (h) In the long run, what fraction of @ThanksSusan tweets are left unresponded by you?
 (i) Suppose Susan pays you \$10 per counter-tweet you write. According to the aforementioned rates, and assuming that you're on duty 24/7, how much money will you earn on average per week by being Susan's ghostwriter on Twitter?
 (j) **(BONUS, 1 point)** Compare the above salary to Connecticut's minimum wage, which is \$8.70 per hour as of 2014. Do you think this job is a bonanza or a rip-off? Justify your answer.

.....END EXAM

²Think the first two weeks of February where we were pummeled by snow.