**CPH 682-001: Quantitative Methods** **Fall 2017**
**Team Project #3** **Dr. Charnigo**

This project covers Chapter 5. Please record your answers in an Excel file called {WB3CPH682F17 LN1 LN2 LN3 LN4.xlsx} and upload the final version into Canvas. Above, LN1 is your last name, while LN2 through LN4 are the last names of your other group members. (Groups with only three persons will have only three last names, obviously.) Members of the same group will have identical files except for the order of the last names in the filename.

1. Consider drawing two cards from a well-shuffled deck. Let A denote the event that the first card drawn is an ace and B the event that the second is an ace. What is P(B | not A) ?

2. Continuing from exercise 1, from class we know that P(A) = 1/13 and P(B | A) = 3/51. Find P(A and B). Then use the Law of Total Probability, with your answer to exercise 1, to calculate P(B). Are A and B independent ?

3. Suppose A = H1N1 and B = positive test. Suppose, moreover, that P(A) = 0.10, P(B|A) = 0.95, and P({not B}|{not A}) = 0.80. (All these probabilities are in the context of other signs or symptoms which are suggestive of some respiratory infection.) By complements, P({not A}) = ____________________ and P(B|{not A}) = _____________________ . By Bayes' Theorem, P(A | B) = _______________________________________________________ .

4. Let us modify the authors' emergency room example (pp. 170-171) by assuming that the number of visitors to the emergency room follows the Poisson distribution with rate $\lambda = 29/8$ per hour. Thus, the expected number of visitors in an eight hour shift is 29. Use Excel to find the probability that the number of visitors in an eight hour shift is x, where x ranges from 0 to 60. (The drag and drop feature of Excel is going to be helpful here.)

5. Given that there are x visitors in an eight hour shift, find the probability that more than 25 of them have true emergencies, assuming that each visitor has a true emergency with probability 0.646 independently of each other visitor. Again, x ranges from 0 to 60.

6. For each x, multiply your answers to exercises 4 and 5. You will have computed a joint probability. Add up all of these joint probabilities. What is the result numerically ? (The result may be interpreted substantively as the probability that more than 25 true emergencies arrive.)

7. Note that $18.734 = 29 \times 0.646$ and find the probability that a Poisson random variable with expected value 18.734 is greater than 25. Compare to the answer in part 6. (The interpretation is that, under the stated assumptions, the number of true emergencies also follows a Poisson distribution, now with rate 18.734/8 per hour.)

8. Find the probability that a normal random variable with mean 18.734 and variance 18.734 is greater than 25. Compare to the answer in part 7. (Although not required, you can get a closer answer to that in part 7 by changing 25 to 25.5, to reflect that a normal random variable is continuous while a Poisson random variable is discrete.)