SOC 4930/5050: Lab-04 - Probability and Bayes' Theorem

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Directions

Complete all of the following questions. Your answers "by hand" should be scanned and submitted as a `pdf` *image. This assignment should be uploaded to your Assignments Repository by 4:15PM on Monday, September 25th, 2017.*

Part 1: Probabilities

For the following questions, let `A` *equal the probability of rolling an odd number with a fair die and let* `B` *equal getting a result less than or equal to 3.*

1. Draw a venn diagram of this space.
2. Use the additive law to find the probability of `A` or `B` occurring.
3. What is the conditional probability of `A` given `B`.
4. Use the multiplicative law to find the probability of both `A` and `B` occurring.
5. Demonstrate that `A` and `B` are independent.

Part 2: Bayes' Theorem

Neighborhood "A" is has a reputation for violent crime, though it has been going down in recent years. The police department estimates that, given this trend as well as a trend where drug arrests have been increasing over the past few months, the probability of the violent crime rate continuing to fall is 20%.

The City Council is interested in investing in cameras to monitor high crime areas. You are asked to evaluate the potential impact of these cameras on the violent crime rate in neighborhood "A". You hypothesize that the introduction of cameras leads to a higher probability of a decrease in the violent crime rate (i.e. the condition).

After conducting a literature review, you find two estimates of the impact of cameras in other cities. The first is that the probability of violent crime rates decreasing given the installation of cameras is 65%. However, other studies caution that in 12% of neighborhoods, the cameras have no impact on violent crime.

6. What is the prior probability (x) given in the scenario above?
7. What is the probability of the condition if the hypothesis is true (y)?
8. What is the probability of the condition if the hypothesis is false (z)?
9. Estimate the posterior probability that the violent crime rate will continue to fall given the introduction of cameras in neighborhood "A".