Math 10B with Professor Stankova
Worksheet, Discussion #10; **Tuesday, 2/20/2018**
GSI name: Roy Zhao

1 Bayes Theorem and Independence

1.1 Concepts

1. We use **Bayes theorem** when we want to find the probability of A given B but we are told the opposite probability, the probability of B given A. There are several forms of Bayes Theorem as follows:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)} = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})} = \frac{1}{1 + \frac{P(B|\bar{A})P(\bar{A})}{P(B|A)P(A)}}.$$

   In order to discern which form to use, look at the information you are given. If you are told $P(B|A)$ as well as $P(B|\bar{A})$, use the latter two methods but if you are only told $P(B)$, then use the first form.

   We say that two events A, B are **independent** if $P(A \cap B) = P(A)P(B)$.

1.2 Examples

2. When rolling a fair 6-sided die, are the events A that the number rolled is greater than or equal to 3, and B that the number rolled is odd, independent?

3. There are 10 red and 10 blue balls in a bag. Someone randomly picks out a ball and then places it back and puts 10 more balls of that color into the bag. Then you draw a ball. What is the probability that the 10 balls added were red, given that you drew out a red ball?

1.3 Problems

4. True False If A, B are mutual exclusive events that are independent, then $P(A) = 0$ or $P(B) = 0$.

5. True False If A, B are independent events and B, C are independent, then A, C are independent.

6. I roll two die. Are the events that the first die roll is a 1 and that the sum of the two dice is a 7 independent?

7. What is the probability that a family with two kids has two boys if you know at least one is a boy?