

cmput-145 spring, 2019

Homework, due April 29.

Problem 1.

Consider a variant of the Monty Hall puzzle with four doors. The host still opens just one door with a goat - not the grand prize - behind it. What is the probability of winning if you always keep your original choice and if you always switch?

Problem 2.

Recall the definition for any events  $A$  and  $B$  to be independent. *Two events,  $A$  and  $B$  are independent iff  $p(A \cap B) = p(A) * p(B)$*  Consider tossing a pair of dice. The outcome can be thought of as an ordered pair,  $(x, y)$ . Let  $A$  be the event of rolling an even number (i.e.,  $x + y$  is even).

Let  $B$  be the event of rolling a 5, 6, or 7 (i.e.,  $x + y$  is 5, 6, or 7). Compute  $p(A)$ ,  $p(B)$ ,  $p(A \cap B)$  and  $p(A) * p(B)$ . Are events  $A$  and  $B$  independent?

Problem 3.

Recall the definition of the probability of an event  $A$  given that event  $B$  occurred:

$p(A | B) = p(A \cap B) / p(B)$ . Compute the conditional probabilities  $p(A | B)$  and  $p(B | A)$  using the events in problem 2 above.

Problem 4.

In recent years, "Nor'easter" storms dump large amounts of snow or rain in Poughkeepsie 5 days each year. (Assume Nor'easter storms last one day, allowing you to work with the total number of days in a year.) When a Nor'easter affects Poughkeepsie, the 'European Model' for weather prognostication correctly predicts this fact 97% of the time. When a Nor'easter does not affect Poughkeepsie, the European Model incorrectly predicts that it will 3% of the time.

(see [https://en.wikipedia.org/wiki/European\\_Centre\\_for\\_Medium-Range\\_Weather\\_Forecasts](https://en.wikipedia.org/wiki/European_Centre_for_Medium-Range_Weather_Forecasts) for more!)

Unfortunately, the European Model is predicting a Nor'easter to affect Poughkeepsie on the day of our final exam! What is the probability that a Nor'easter actually occurs on the day of our final exam?

(Hint: one way to start is to state the events we care about, and then the probabilities of these events occurring. )