Lecture 7: Probability

Chapter 2.x

Outcomes

Disjoint AKA Mutually Exclusive Outcomes

Addition Rule of Probability

General Addition Rule of Probability

Sample Space and the Complement of Events

Independence

Two processes are independent if knowing the outcome of one provides no useful information about the outcome of the other. Otherwise they are dependent.

Consider:

1. Die rolls
2. You get a movie recommendation from your friend Robin, but then their significant other Sam also recommends it.
3. You compare test scores from two Grade 9 students in the same class. Then same school. Then same school district. Then same city. Then same state.

Independence

Conditional Probability

Example

Let's suppose I take a random sample of 100 Midd kids to study their smoking habits.

	Smoker	Not Smoker	Total
Male	19	41	60
Female	12	28	40
Total	31	69	100

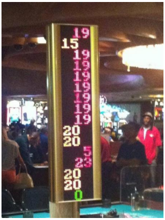
Put It Together! Independence and Conditional Prob.

Gambler's Fallacy: Roulette

You can bet on individual numbers, sets of numbers, or red vs black. Let's assume no 0 or 00, so that $P(R) = P(B) = \frac{1}{2}$.

Gambler's Fallacy: Roulette

One of the biggest cons in casinos: spin history boards.



Let's ignore the numbers and just focus on what color occurred.
Note: the white values on the left are black spins.

Gambler's Fallacy: Roulette

Let's say you look at the board and see that the last 4 spins were red. You will always hear people say "Black is due!"

Ex. on the 5th spin people think:

$$
\begin{aligned}
P(B_5 \mid R_1 \text{ and } R_2 \text{ and } R_3 \text{ and } R_4) &> \\
P(R_5 \mid R_1 \text{ and } R_2 \text{ and } R_3 \text{ and } R_4)
\end{aligned}
$$

Gambler's Fallacy: Roulette

But assuming the wheel is not rigged, spins are independent i.e. $P(A|B) = P(A)$. So:

$$P(B_5|R_1 \text{ and } R_2 \text{ and } R_3 \text{ and } R_4) = P(B_5) = \frac{1}{2}$$
$$P(R_5|R_1 \text{ and } R_2 \text{ and } R_3 \text{ and } R_4) = P(R_5) = \frac{1}{2}$$

Next Time

Discuss the Normal Distribution