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CS109

Section #1
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Section #1: Analytic Probability

1. Assume that birthdays happen on any of the 365 days of the year with equal likelihood.

a. What is the probability that of the n people in your section, at least two people share the same birthday?

b. What is the probability that at least one person has a birthday in the 8 weeks of section?

2. Shazam, an application which can predict what song is playing. Based on the frequency of requests, they have the following prior beliefs as to what song is playing:

- 80% chance of event X_1, the song is Hold Up by Beyonce
- 15%chance of event X_2, the song is Can't Get Used to Losing You by Andy Williams
- 5% chance of event X_3, the song is the pink panther theme song.

When a request is made Shazam receives and audio sample (H) that it uses to update it's belief. From the audio sample Shazam estimates that

- $P(H|X_1) = 0.50$
- $P(H|X_2) = 0.90$
- $P(H|X_3) = 0.30$

What is the updated probability that the song is Beyonce given the audio sample heard?

3. The probability that a Netflix user likes a movie M_i is p_i.

Assume that liking movie M_a and M_b are independent events for all a and b. Express all your answers in terms of ps.

a. What is the probability of a user liking M_1, M_2 and M_3?

b. What is the probability of a user liking M_1, M_2 or M_3?

4. Optional: Breakout is a CS106A assignment that is used around the world to teach computer science. For a research project to autonomously grade Breakout assignments, you need a lot of unique breakout examples. You decide to generate 10 million unique breakout solutions by encoding binary decisions (e.g. bricks are colored vs bricks are not colored, or the paddle moves vs the paddle does not move). How many different binary decisions do you need to encode in order to generate 10 million unique breakout solutions?