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Section 1: Core Probability

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1   Warm-Up with Music Preferences

In one prior offering of CS109, the distribution of students by year and their likelihood of liking the song *We Are the Champions* by Queen is shown in the table below. Here, "Graduate +" includes graduate students, CGOE students, coterminal students (everyone not in the other partitions). Let L_1 denote the event that a student likes the song.

Year	% of Students	$P(L_1 \mid$ Year$)$
Freshman	20%	0.23
Sophomore	25%	0.42
Junior	25%	0.39
Senior	10%	0.74
Graduate +	20%	0.89

What is the probability that a randomly chosen student likes *We Are the Champions* by Queen?

2   WebMD mini

In this problem, we will compute the probability that a person has a particular disease given that they present with the symptom of a fever. A person may have either *Influenza (Flu)*, *Streptococcal Pharyngitis (Strep)*, or *No Disease*. Assume these outcomes are mutually exclusive, so each person belongs to exactly one of the three groups: Flu, Strep, or No Disease.

In the general population, 8% of people have Influenza (Flu), 4.1% have Streptococcal Pharyngitis (Strep), and the remaining 87.9% have no disease. If a person has the flu, the probability they have a fever is 0.92. If they have strep, the probability they have a fever is 0.86. If they have no disease, the probability they have a fever is 0.01.

For each disease (Flu, Strep, No Disease), compute the probability that a person has that disease given that they present with a **fever**.

3   The Birthday Problem

When solving a counting problem, it can often be useful to come up with a generative process, a series of steps that "generates" examples. A correct generative process to count the elements of set *A* will (1) *generate every element of A* and (2) *not generate any element of A more than once*. If our process has the added property that (3) *any given step always has the same number of possible outcomes*, then we can use the product rule of counting.

Assume that birthdays happen on any of the 365 days of the year with equal likelihood (we'll ignore leap years).

a. **Warmup:** How many ways can you choose birthdays for two (distinct) people?

b. What is the probability that of the n people in class, at least two people share the same birthday?