1. Customers arriving at a restaurant

Problem 1. Customers arriving at a restaurant

2.0/2.0 points (graded)

Six customers enter a three-floor restaurant. Each customer decides on which floor to have dinner. Assume that the decisions of different customers are independent, and that for each customer, each floor is equally likely. Find the probability that exactly one customer dines on the first floor.

64/243 ✔ **Answer:** 0.2633

Solution:

Solution 1 (Counting): Since each customer has three possible choices, the sample space consists of $3^6 = 729$ different seating assignments.

Of these assignments, in order to find those satisfying the problem's requirements, we count as follows. First, we select a person to dine on first floor. There are $\binom{6}{1}$ different ways of doing this. After that, the remaining 5 people can each select among two floors, which can be done in 2^5 ways. Hence, in total, we have $\binom{6}{1} \times 2^5 = 192$ different ways.

Therefore, the desired probability is $192/729 = 64/243 \approx 0.2633$.

Solution 2: The number of customers dining on the first floor is a Binomial random variable, with parameters $n = 6$ and $p = 1/3$. This is because we can interpret each customer as an i.i.d. Bernoulli trial, with success probability $1/3$, where a success corresponds to choosing the first floor. Thus,

$$\mathbb{P}(\text{Bin}(6, 1/3) = 1) = \binom{6}{1}\left(\frac{1}{3}\right)^1 \cdot \left(\frac{2}{3}\right)^5 \approx 0.2633,$$

as in the first solution.

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Answers are displayed within the problem

讨论

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