![edX logo] **MITx: 6.008.1x Computational Probability and Inference**

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▸ Introduction

▾ **1. Probability and Inference**

Introduction to Probability (Week 1)
Exercises due Sep 22, 2016 at 02:30 IST   ✎

Probability Spaces and Events (Week 1)
Exercises due Sep 22, 2016 at 02:30 IST   ✎

Random Variables (Week 1)
Exercises due Sep 22, 2016 at 02:30 IST   ✎

Jointly Distributed Random Variables (Week 2)
Exercises due Sep 29, 2016 at 02:30 IST   ✎

Conditioning on Events (Week 2)
Exercises due Sep 29, 2016 at 02:30 IST   ✎

Exercise: The Soda Machine

(3/3 points)

A soda machine advertises 7 different flavors of soda. However, there is only one button for buying soda, which dispenses a flavor of the machine's choosing. Adam buys 14 sodas today, and notices that they are all either grape or root beer flavored.

- **(a)** Assuming that the soda machine actually dispenses each of its 7 flavors randomly, with equal probability, and independently each time, what is the probability that all 14 of Adam's sodas are either grape or root beer flavored? (Please be precise with at least **10 decimal places**, unless of course the answer doesn't need that many decimal places. You could also put a fraction.)

  | 0.0000000242 | ✔   **Answer:** $(2/7)^{14}$

- **(b)** How would your answer to the (a) change if the machine were out of diet cola, ginger ale, so it randomly chooses one of only 5 flavors? (Please be precise with at least **10 decimal places**, unless of course the answer doesn't need that many decimal places. You could also put a fraction.)

  | 0.0000026844 | ✔   **Answer:** $(2/5)^{14}$

- **(c)** What if the machine only had 3 flavors: grape, root beer, and cherry? (Please be precise with at least **10 decimal places**, unless of course the answer doesn't need that many decimal places. You could also put a fraction.)

  > 0.0034254874

  ✔ **Answer:** $(2/3)\text{\textasciicircum}14$

Solution:

- **(a)** Assuming that the soda machine actually dispenses each of its 7 flavors randomly, with equal probability, and independently each time, what is the probability that all 14 of Adam's sodas are either grape or root beer flavored?

  Solution: Let's first consider a single soda, which could be one of 7 flavors, 2 of which are desired. Thus the probability of the soda being either grape or root beer is $\frac{2}{7}$. Since each soda is dispensed independently, the probability of all 14 sodas being grape or root beer is $\left(\frac{2}{7}\right)^{14} \approx 2.416 \times 10^{-8}$.

- **(b)** How would your answer to the (a) change if the machine were out of diet cola, ginger ale, so it randomly chooses one of only 5 flavors?

  Solution: If there are only 5 flavors of soda available, the probability of getting either grape or root beer is $\frac{2}{5}$. Thus, once again assuming each soda is chosen independently, the probability that all 14 sodas are grape or root beer is $\left(\frac{2}{5}\right)^{14} \approx 2.684 \times 10^{-6}$.

- **(c)** What if the machine only had 3 flavors: grape, root beer, and cherry?

  Solution: Similarly, with only 3 flavors to choose from, the probability becomes $\left(\frac{2}{3}\right)^{14} \approx 0.003425$.

You have used 1 of 5 submissions

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