

Week 1 - Math Assignment

Question 2.12

(a) What is the probability that a student chosen at random doesn't miss any days of school due to sickness this year?

Answer: 0.32

$1 - (\text{Probability of missing 1 day or 2 days or 3 or more days}) = 1 - (.25 + .15 + .28)$

(b) What is the probability that a student chosen at random misses no more than one day?

Answer: 0.57 (Probability of missing exactly one day (0.25) + probability of missing zero day (0.32))

(c) What is the probability that a student chosen at random misses at least one day?

Answer: 0.68

Probability of missing 1 day or 2 days or 3 or more days = $.25 + .15 + .28$

(d) If a parent has two kids at a DeKalb County elementary school, what is the probability that neither kid will miss any school? Note any assumption you must make to answer this question.

Answer: 0.1024 ($0.32 * 0.32$)

Assumption: The probability of one kid missing the school is independent of the probability of the other kid missing the school

(e) If a parent has two kids at a DeKalb County elementary school, what is the probability that that both kids will miss some school, i.e. at least one day? Note any assumption you make.

Answer: 0.4624 ($0.68 * 0.68$)

Assumption: The probability of one kid missing the school is independent of the probability of the other kid missing the school

(f) If you made an assumption in part (d) or (e), do you think it was reasonable? If you didn't make any assumptions, double check your earlier answers.

Assumption made earlier (i.e. Probability of one kid missing school is independent of the probability of the other kid missing the school) may not be reasonable. It's highly likely that if one kid falls sick, the other kid falls sick as well.

Question 2.14

(a) If we draw one individual at random, what is the probability that the respondent is overweight and doesn't have health coverage?

Answer: 0.03575745 (15327/428638)

(b) If we draw one individual at random, what is the probability that the respondent is overweight or doesn't have health coverage?

Answer: 0.4351831

probability that the respondent is overweight or doesn't have health coverage =

Probability of respondent overweight

+ Probability of respondent doesn't have health coverage

- Probability of respondent is overweight and doesn't have health coverage

Question 2.28

(a) 2 blue socks

Answer: $\frac{12}{132} = 0.090909$

$$\begin{aligned} & \text{probability of picking first blue sock} * \text{probability of second sock is blue} \\ &= \frac{4}{12} * \frac{3}{11} = \frac{12}{132} \end{aligned}$$

(b) no gray socks

Answer: $\frac{42}{132} = 0.3181818$

$$\begin{aligned} & \text{probability of not gray sock} * \text{probability of not gray sock} \\ &= \frac{7}{12} * \frac{6}{11} = \frac{42}{132} \end{aligned}$$

(c) at least 1 black sock

Answer: $\frac{60}{132} = 0.4545455$

$$\begin{aligned} & 1 - \text{probability of getting no black sock} \\ &= 1 - \left(\frac{9}{12} * \frac{8}{11} \right) = \frac{60}{132} \end{aligned}$$

(d) a green sock

Answer: 0

There is no green sock in the sock drawer

(e) matching socks

Answer: $\frac{38}{132} = 0.2878788$

Probability of two blue or Probability of two gray or Probability of two black

$$= \left(\frac{4}{12} * \frac{3}{11} \right) + \left(\frac{5}{12} * \frac{4}{11} \right) + \left(\frac{3}{12} * \frac{2}{11} \right) = \frac{38}{132}$$

Question 2.30

(a) Find the probability of drawing a hardcover book first then a paperback fiction book second when drawing without replacement.

Answer: 0.1849944

$$\frac{28}{95} * \frac{59}{94} = \frac{1652}{8930} = 0.1849944$$

(b) Determine the probability of drawing a fiction book first and then a hardcover book second, when drawing without replacement.

Answer: 0.2243001

$$\begin{aligned} & \text{Probability of (Hardcover book | Hardcover Fiction Book)} \\ & + \text{Probability of (Hardcover book | Paperback Fiction Book)} = \\ & \frac{13}{95} * \frac{27}{94} + \frac{59}{95} * \frac{28}{94} = \frac{2003}{8930} = 0.2243001 \end{aligned}$$

(c) Calculate the probability of the scenario in part (b), except this time complete the calculations under the scenario where the first book is placed back on the bookcase before randomly drawing the second book.

Answer: 0.2233795

$$\begin{aligned} & \text{Probability of fiction book} * \text{Probability of hardcover book (after replacement)} = \\ & = \frac{72}{95} * \frac{28}{95} = \frac{2016}{9025} = 0.2233795 \end{aligned}$$

(d) The final answers to parts (b) and (c) are very similar. Explain why this is the case.

Answer: The difference between probability of selecting a hardcover book with replacement and without replacement is small given that there are 95 books in total. The effect of replacement is further reduced when the probability is considered given the first book taken is a fiction book. The effect of replacement will be more if the total number of books is a small number.