MIT Introduction to Statistics 18.05 Reading 3

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Contents

1 References and License

We are answering questions in the material from MIT OpenCourseWare course 18.05, Introduction to Probability and Statistics.
Please see the references section for detailed citation information.

2 What is $P\left(S_2 \mid S_1^{\complement}\right)$

S_1 = 'first card is a spade' S_2 = 'second card is a spade'
Therefore $S_2^{\complement}$ = 'second card is not a spade
We will calculate

$$P\left(S_2 \mid S_1^{\complement}\right) \tag{1}$$

That is, we will calculate the probability that the first card is a spade given that the second card is not a spade.
We will apply the same method Orloff and Bloom use in [1], section 3, "Multiplication Rule."
If the first card is a spade then of the 51 cards remaining, $3 \times 13 = 39$ cards are not spades.
Therefore

$$P\left(S_2 \mid S_2^{\complement}\right) = \frac{39}{51} \approx 0.765 \tag{2}$$

We use the multiplication rule from [1] to compute the same probability.
We apply the multiplcation rule letting $A = S_1$ and $B = S_2^{\complement}$

$$P\left(S_1 \mid S_2^{\complement}\right) \cdot = \frac{P\left(S_1 \cap S_2^{\complement}\right)}{P\left(S_2^{\complement}\right)} \tag{3}$$

First we calculate $P\left(S_1 \cap S_2^{\complement}\right)$.
There are

References

[1] Jeremy Orloff and Jonathan Bloom. *Conditional Probability, Independence and Bayes Theorem Class 3, 18.05, Spring 2014*. Available at `https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/MIT18_05S14_Reading3.pdf`(Spring 2014).