1. Two five-sided dice

Problem Set due Feb 12, 2020 05:29 IST *Completed*

Problem 1. Two five-sided dice

4/4 points (graded)

You roll two five-sided dice. The sides of each die are numbered from 1 to 5. The dice are “fair"" (all sides are equally likely), and the two die rolls are independent.

Part (a): Event A is “the total is 10" (i.e., the sum of the results of the two die rolls is 10).

1. Is event A independent of the event “at least one of the dice resulted in a 5"?

   No ✔ **Answer:** No

2. Is event A independent of the event “at least one of the dice resulted in a 1"?

   No ✔ **Answer:** No

Part (b): Event B is “the total is 8."

1. Is event B independent of getting “doubles" (i.e., both dice resulting in the same number)?

   No ✔ **Answer:** No

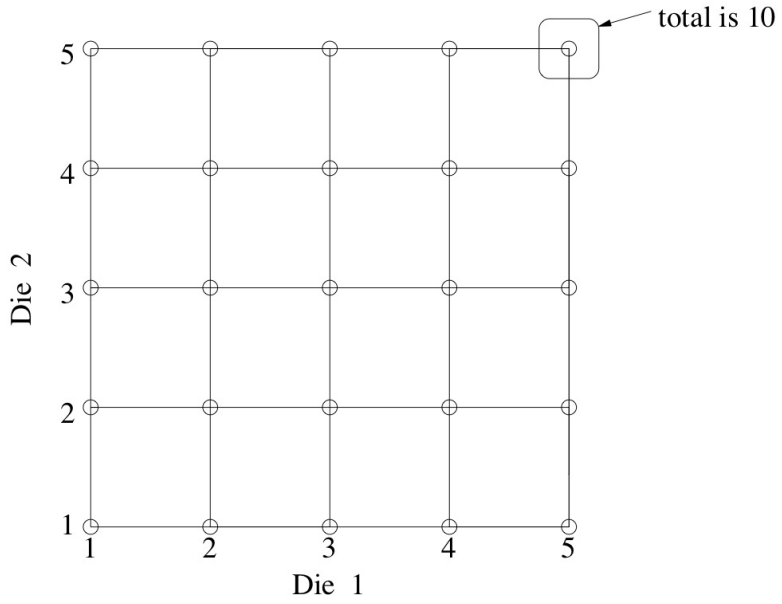
2. Given that the total was 8, what is the probability that at least one of the dice resulted in a 3?

   2/3 ✔ **Answer:** 0.66667

Solution:

Part (a):

1. No. A mathematical derivation is as follows:
   Let event A be “the total is 10," and event C be “at least one of the dice resulted in a 5".



   Overall, there are 25 possible and equally likely outcomes. For a total of 10, we must get a 5 on both dice. Therefore, out of the 25 outcomes, only one of them will result in a total of 10. Therefore, $\mathbf{P}(A) = \frac{1}{25}$.

   Next, for at least one die to result in a 5, we can have 5 on the first die, a 5 on the second die, or a 5 on both dice. This corresponds to 9 possible outcomes and so $\mathbf{P}(C) = \frac{9}{25}$.

   We then notice that if we have a total of 10 (event A), then both dice must have resulted in a 5, and event C also occurs. Thus,

$$\mathbf{P}(A \cap C) = \mathbf{P}(A) = \frac{1}{25} \neq \mathbf{P}(A) \cdot \mathbf{P}(C) = \frac{1}{25} \cdot \frac{9}{25}.$$

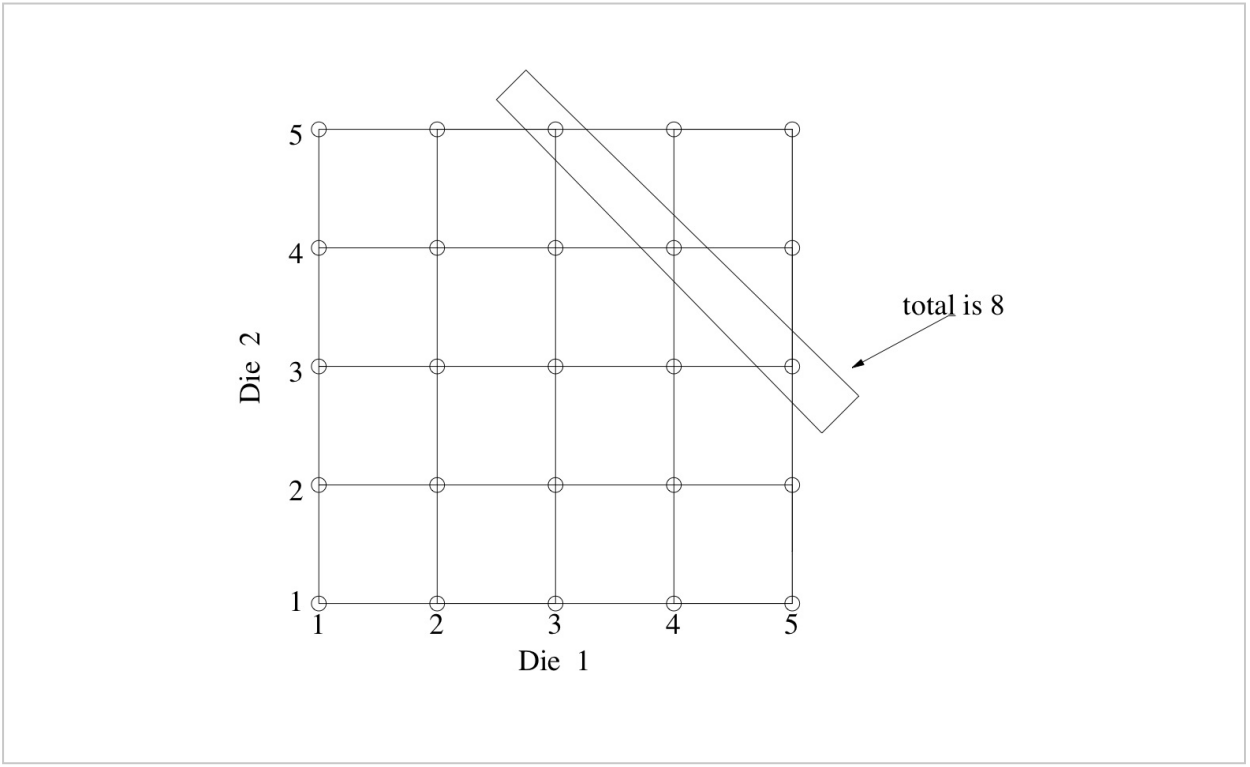
2. No. Let A be the event that “the total is 10", and let D be the event “at least one of the dice resulted in a 1". Similar to event C described in part 1, $\mathbf{P}(D) = \frac{9}{25}$

Next, let us consider $\mathbf{P}(A \cap D)$. We notice that if one of the dice resulted in a 1, it is impossible to get a total of 10. Therefore, $\mathbf{P}(A \cap D) = \mathbf{P}(\emptyset) = 0$, and

$$0 = \mathbf{P}(A \cap D) \neq \mathbf{P}(A) \cdot \mathbf{P}(D) > 0.$$

Part (b):

1. No. Let B be the event "the total is 8" and let E be the event that doubles are obtained.



Event B consists of the three outcomes $(3,5)$, $(4,4)$, and $(5,3)$. Therefore, $\mathbf{P}(B) = \frac{3}{25}$.

Event E occurs in 5 out of the 25 possible outcomes, and so $\mathbf{P}(E) = \frac{5}{25} = \frac{1}{5}$.

Therefore,

$$\mathbf{P}(B \cap E) = \mathbf{P}(\{(4,4)\}) = \frac{1}{25} \neq \mathbf{P}(B) \cdot \mathbf{P}(E) = \frac{3}{25} \cdot \frac{1}{5}.$$

2.

$$\begin{aligned}\mathbf{P}\left(\text{at least one 3} \mid \text{total is 8}\right) &= \frac{\mathbf{P}\left(\text{at least one 3 and total is 8}\right)}{\mathbf{P}\left(\text{total is 8}\right)} \\ &= \frac{\mathbf{P}\left(\{(3,5),(5,3)\}\right)}{\mathbf{P}\left(B\right)} \\ &= \frac{2/25}{3/25} \\ &= \frac{2}{3}.\end{aligned}$$

Submit You have used 2 of 3 attempts

Answers are displayed within the problem

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- Just wondering why can't I submit the answers now? — 4
  Just wondering why can't I submit the answers now? The due date was showing CST 7:59 12 Feb, it is not ...
- Given total is 8... — 5
  I think I am missing something easy here. Possible solutions for achieving 8 are: - 2,6 - 3,5 - 4,4 - 5,3 - 6,2 ...
- part (b). 1. — 2
- likelihood of {4,4} — 1 new — 3
  Don't you think that the likelihood of {4,4} is twice as {5,3}?
- When do we see the solutions? — 2
  I answered the questions, and I want to make sure I did it the right way. But submitting the answer still d...
- How many rolls? — 5
  The first sentence says: *You roll two five-sided dice*, which implies that there is one roll, however later,...
- why does event A depend on " at least one roll is 1" — 4
  Hello, I don't get why event A is dependent of the event " at least one dice roll is 1 "

? Not entirely understanding what is meant by independent

I find it easier to think of the inverse of what is being asked. ex. "Is "A" dependent of the event"? If "A" ca...

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