

# Problem 12.13.1.10

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question: A black and a red dice are rolled.

(a) find the conditional probability of obtaining a sum greater than 9, given that the black dice resulted in a 5.

(b) find the conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.

**Solution:** (a) let us assume events A and B represent

A: black dice resulted in a 5

B: obtaining the sum greater than 9

we need to find  $\Pr(B | A)$ ,

$$\Pr(B | A) = \frac{\Pr(BA)}{\Pr(A)} \quad (1)$$

$$\Pr(A) = \frac{1}{6} \quad (2)$$

For  $\Pr(BA)$  the elements in the sample space are 36 and as given black dice resulted 5 so favorable are

(number obtained in red dice, number obtained in black die) = (5,5), (6,5)

$$\Pr(BA) = \frac{2}{36} \quad (3)$$

$$= \frac{1}{18} \quad (4)$$

Hence

$$\Pr(B | A) = \frac{\frac{1}{18}}{\frac{1}{6}} \quad (5)$$

$$= \frac{1}{3} \quad (6)$$

(b) let us assume events C and D represent

C: red dice resulted in a number less than 4

D: obtaining the sum 8

we need to find  $\Pr(D | C)$ ,

For  $\Pr(C)$  as given that the result that needed to be obtained must be less than 4, i.e. the favourable case is with getting numbers 1, 2, 3 as result and the sample space elements be 6.

therefore,

$$\Pr(C) = \frac{3}{6} = \frac{1}{2} \quad (7)$$

For  $\Pr(DC)$  the elements in the sample space are 36 and as given red dice is resulted in a number less than 4 so favorable cases such that obtained sum is 8 are

(number obtained in red dice, number obtained in black die) = (2,6), (3,5)

therefore

$$\Pr(DC) = \frac{2}{36} = \frac{1}{18} \quad (8)$$

Hence

$$\Pr(D | C) = \frac{\Pr(DC)}{\Pr(C)} \quad (9)$$

$$= \frac{\frac{1}{18}}{\frac{1}{2}} \quad (10)$$

$$= \frac{1}{9} \quad (11)$$