EE23010 Assignment

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Question 10.13.3.19

Two dice are thrown at the same time. Find the probability of getting

(i) same number on both dice.
(ii) different numbers on both dice.

Solution: Let the random variables:

X represent the outcome of the first die,

Y represent the outcome of the second die.

Since each die has 6 sides, both X and Y can take on values from the set 1, 2, 3, 4, 5, 6.

Let

$$k = X - Y \tag{1}$$

k can take values ranging from -5 to 5.

We need to find the distribution of $X - Y$:

(X, Y)	$X - Y$	$p_{X-Y}(k)$
(1,6)	-5	$\frac{1}{36}$
(1,5), (2,6)	-4	$\frac{2}{36}$
(1,4), (2,5), (3,6)	-3	$\frac{3}{36}$
(1,3), (2,4), (3,5), (4,6)	-2	$\frac{4}{36}$
(1,2), (2,3), (3,4), (4,5), (5,6)	-1	$\frac{5}{36}$
(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)	0	$\frac{6}{36}$
(2,1), (3,2), (4,3), (5,4), (6,5)	1	$\frac{5}{36}$
(3,1), (4,2), (5,3), (6,4)	2	$\frac{4}{36}$
(4,1), (5,2), (6,3)	3	$\frac{3}{36}$
(5,1), (6,2)	4	$\frac{2}{36}$
(6,1)	5	$\frac{1}{36}$

TABLE 0

DISTRIBUTION OF $X - Y$

(i) From the table 0, we get:

The PMF of $X - Y$ as:

$$p_{X-Y}(k) = \begin{cases} \frac{1}{36}, & k = -5 \\ \frac{2}{36}, & k = -4 \\ \frac{3}{36}, & k = -3 \\ \frac{4}{36}, & k = -2 \\ \frac{5}{36}, & k = -1 \\ \frac{6}{36}, & k = 0 \\ \frac{5}{36}, & k = 1 \\ \frac{4}{36}, & k = 2 \\ \frac{3}{36}, & k = 3 \\ \frac{2}{36}, & k = 4 \\ \frac{1}{36}, & k = 5 \end{cases} \tag{2}$$

From the PMF of $X - Y$ we get:

$$Pr(X = Y) = p_{X-Y}(0) \tag{3}$$

$$p_{X-Y}(0) = \frac{6}{36} \tag{4}$$

$$= \frac{1}{6} \tag{5}$$

(ii) From 5, we get:

$$Pr(X \neq Y) = 1 - p_{X-Y}(0) \tag{6}$$

$$= 1 - \frac{1}{6} \tag{7}$$

$$= \frac{5}{6} \tag{8}$$