Answer on Question #43271 – Math - Statistics and Probability

Let a fair die be rolled 2 times. Let's assume that the 2 rolls are independent. Let X and Y be the outcomes of the first and second rolls, respectively.

a. What is the probability distribution of X+Y? That is, create a table that contains each unique possible value of X+Y (each value only listed once) and each possibility's corresponding probability.

b. What is the probability that X+Y is greater or equal to 10?

Solution

The distribution of one outcome is

outcome	probability
1	1/6
2	1/6
3	1/6
4	1/6
5	1/6
6	1/6

We calculate joint distribution $P(X = k, Y = l)$, $k, l = 1, ..., 6$. If X and Y are independent random variables then $P(X = k, Y = l) = P(X = k)P(Y = l)$. The joint distribution of X and Y is

	1	2	3	4	5	6
1	1/36	1/36	1/36	1/36	1/36	1/36
2	1/36	1/36	1/36	1/36	1/36	1/36
3	1/36	1/36	1/36	1/36	1/36	1/36
4	1/36	1/36	1/36	1/36	1/36	1/36
5	1/36	1/36	1/36	1/36	1/36	1/36
6	1/36	1/36	1/36	1/36	1/36	1/36

We calculate possibilities of outcome X + Y. For value 2 we have one way when X = 1 and X = 1 only. For 3 we have two ways X = 1 and Y = 2 or X = 2 and Y = 1.

Outcome, X + Y	Possibilities
2	1
3	1 + 1
4	1 + 1 + 1
5	1 + 1 + 1 + 1
6	1 + 1 + 1 + 1 + 1
7	1 + 1 + 1 + 1 + 1 + 1
8	1 + 1 + 1 + 1 + 1
9	1 + 1 + 1 + 1
10	1 + 1 + 1
11	1 + 1
12	1

a)

We calculate probability multiply possibility to probability with possibilities of outcome of X + Y.

Outcome, X + Y	Probability
2	1/36
3	1/18
4	1/12
5	1/9
6	5/36
7	1/6
8	5/36
9	1/9
10	1/12
11	1/18
12	1/36

b) $P(X + Y \geq 10) = \frac{1}{12} + \frac{1}{18} + \frac{1}{36} = \frac{1}{6}$