

Assignment 1- Probability and Random Variables

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Download all python codes from

https://github.com/KoteschSatvik/AI1103-Probability_and_Random_Variables/tree/main/Assignment-1/Assignment1.py

and latex-tikz codes from

https://github.com/KoteschSatvik/AI1103-Probability_and_Random_Variables/tree/main/Assignment-1/Assignment1.tex

x	2	3	4	5	6	7	8	9	10	11	12
P(X)	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

$$\begin{aligned}
 \text{Mean} &= \sum XP(X) \\
 &= \frac{1}{36}[(2 \times 1) + (3 \times 2) + (4 \times 3) + (5 \times 4) + (6 \times 5) \\
 &\quad + (7 \times 6) + (8 \times 5) + (9 \times 4) + (10 \times 3) + (11 \times 2) \\
 &\quad + (12 \times 1)] \\
 &= \frac{252}{36} = 7
 \end{aligned}$$

1 PROBLEM 4.9

Let X denote the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of X.

2 SOLUTION

When two fare dice are rolled. The sum of the numbers obtained can have the values 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

P(X) = probability of obtaining X as the sum and let us represent the case when first dice shows the number x_1 and the second dice shows the number x_2 as (x_1, x_2) .

Then,

$P(X=2) = 1/36 : [(1,1)]$
 $P(X=3) = 2/36 : [(1,2),(2,1)]$
 $P(X=4) = 3/36 : [(1,3),(2,2),(3,1)]$
 $P(X=5) = 4/36 : [(1,4),(2,3),(3,2),(4,1)]$
 $P(X=6) = 5/36 : [(1,5),(2,4),(3,3),(4,2),(5,1)]$
 $P(X=7) = 6/36 : [(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)]$
 $P(X=8) = 5/36 : [(2,6),(3,5),(4,4),(5,3),(6,2)]$
 $P(X=9) = 4/36 : [(3,6),(4,5),(5,4),(6,3)]$
 $P(X=10) = 3/36 : [(4,6),(5,5),(6,4)]$
 $P(X=11) = 2/36 : [(5,6),(6,5)]$
 $P(X=12) = 1/36 : [(6,6)]$

$$\begin{aligned}
 \text{Variance} &= \sum X^2 P(X) - \bar{X}^2 \\
 &= \frac{1}{36}[(2^2 \times 1) + (3^2 \times 2) + (4^2 \times 3) + (5^2 \times 4) \\
 &\quad + (6^2 \times 5) + (7^2 \times 6) + (8^2 \times 5) + (9^2 \times 4) \\
 &\quad + (10^2 \times 3) + (11^2 \times 2) + (12^2 \times 1)] - (7)^2 \\
 &= \frac{1974}{36} - 49 \\
 &= \frac{1974 - 1764}{36} \\
 &= \frac{210}{36} = \frac{35}{6}
 \end{aligned}$$

Therefore,

$$\text{Standard Deviation} = \sqrt{\frac{35}{6}}$$

The probability distribution table is