# Assignment 9

Parvez Alam : AI21RESCH01005

March 2021

Python code link:https://github.com/ParvezAlam123/Assignment-9

## 1 Prob. Misc. 5.29

**Let a pair of dice be thrown and the random variable X be the sum of the numbers that appear on the two dice. Find the mean or expectation of X.**

**Solution:** Let $X_1$ be random variable for first dice and$X_2$ be random variable for second dice

$$X_1, X_2 \in \{1, 2, 3, 4, 5, 6\}$$
$$X = X_1 + X_2$$
$$X \in \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

| X | outcomes |
|---|---|
| 2 | (1,1) |
| 3 | (1,2),(2,1) |
| 4 | (1,3),(2,2),(3,1) |
| 5 | (1,4),(2,3),(3,2),(4,1) |
| 6 | (1,5),(2,4),(3,3),(4,2),(5,1) |
| 7 | (1,6),(2,5),(3,4),(4,3),(5,2),(6,1) |
| 8 | (2,6),(3,5),(4,4),(5,3),(6,2) |
| 9 | (3,6),(4,5),(5,4),(6,3) |
| 10 | (4,6),(5,5),(6,4) |
| 11 | (5,6),(6,5) |
| 12 | (6,6) |

$$P(X = 2) = P(X_1 + X_2 = 2) = \frac{1}{36}$$
$$P(X = 3) = P(X_1 + X_2 = 3) = \frac{2}{36}$$
$$P(X = 4) = P(X_1 + X_2 = 4) = \frac{3}{36}$$
$$P(X = 5) = P(X_1 + X_2) = \frac{4}{36}$$
$$P(X = 6) = P(X_1 + X_2 = 6) = \frac{5}{36}$$
$$P(X = 7) = P(X_1 + X_2 = 7) = \frac{6}{36}$$
$$P(X = 8) = P(X_1 + X_2 = 8) = \frac{5}{36}$$
$$P(X = 9) = P(X_1 + X_2 = 9) = \frac{4}{36}$$
$$P(X = 10) = P(X_1 + X_2 = 10) = \frac{3}{36}$$
$$P(X = 11) = P(X_1 + X_2 = 11) = \frac{2}{36}$$
$$P(X = 12) = P(X_1 + X_2 = 12) = \frac{1}{36}$$

**Expectation:**

$$
\begin{aligned}
E[X] &= \sum_{i=1}^{12} x_i P(X = x_i) \\
&= 2 \times \frac{1}{36} + 3 \times \frac{2}{36} \\
&+ 4 \times \frac{3}{36} + 5 \times \frac{4}{36} \\
&+ 6 \times \frac{5}{36} + 7 \times \frac{6}{36} \\
&+ 8 \times \frac{5}{36} + 9 \times \frac{4}{36} \\
&+ 10 \times \frac{3}{36} + 11 \times \frac{2}{36} \\
&+ 12 \times \frac{1}{36} \\
&= \frac{1}{36}(2 + 6 + 12 + 20 + 30 \\
&+ 42 + 40 + 36 + 30 + 22 + 12) \\
&= 6.444
\end{aligned}
$$