

# Assignment 7

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# Question

## Papoulis 3.8

A pair of dice is rolled  $n$  times. (a) Find the probability that "seven" will not show at all. (b) (Pascal) Find the probability of obtaining double six at least once.

# Answer

The space of single roll of two dice consists of the 36 elements  $f_i f_j$ ,  $i, j = 1, 2, \dots, 6$ .

## Part-1

Let A be the event

A: Sum is seven

The event A consist of six elements

$$f_1 f_6, f_2 f_5, f_3 f_4, f_4 f_3, f_5 f_2, f_6 f_1 \quad (1)$$

Therefore, probability of A is

$$P(A) = \frac{6}{36} = \frac{1}{6} \quad (2)$$

(3)

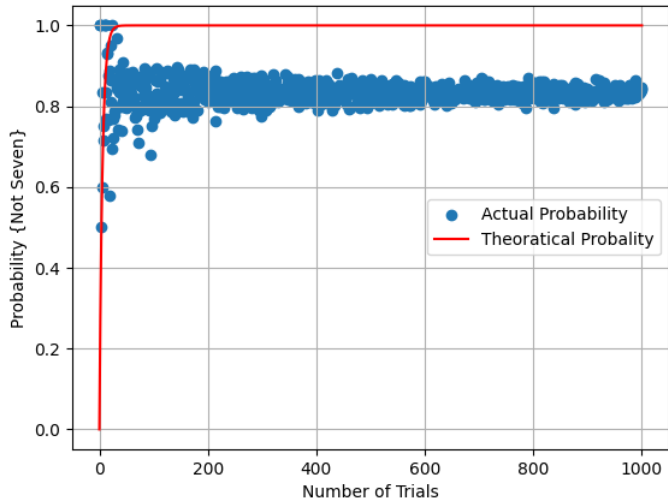
and

$$P(\bar{A}) = 1 - P(A) \quad (4)$$

$$= 1 - \frac{1}{6} = \frac{5}{6} \quad (5)$$

Therefore, for n trials

$$P_n(0) = \left(\frac{5}{6}\right)^n \quad (6)$$



## Part-2

Let B be the event

B: Double six

The event B consist of only one element

$$f_6 f_6 \quad (7)$$

Therefore, probability of B is

$$P(B) = \frac{1}{36} \quad (8)$$

$$(9)$$

and probability of  $\bar{B}$  is

$$P(\bar{B}) = 1 - P(B) \quad (10)$$

$$= 1 - \frac{1}{36} = \frac{35}{36} \quad (11)$$

$$(12)$$



Let

$X$  = There will be atleast one double six in  $n$  rolls

$\bar{X}$  = There will be no any double six in  $n$  rolls

$$\bar{X} = \bar{B} \times \bar{B} \times \dots \times \bar{B} \quad (13)$$

$$\implies P(\bar{X}) = (P(\bar{B}))^n \quad (14)$$

$$\implies P(\bar{X}) = \left(\frac{35}{36}\right)^n \quad (15)$$

$$\implies P(X) = 1 - P(\bar{X}) \quad (16)$$

$$\implies P(X) = 1 - \left(\frac{35}{36}\right)^n \quad (17)$$

