

Assignment-4

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Problem Statement

(Papoulis pillai probability RandomVariable Example 4-20) A fair coin is tossed 1000 times. Find the probability P_a that heads will show 500 times and the probability P_b that heads will show 510 times.

Solution

$$p = q = 0.5, n = 1000, \sqrt{npq} = 5\sqrt{10}$$

DeMoivre-Laplace Theorem

$$\binom{n}{k} p^k q^{n-k} \simeq \frac{1}{\sqrt{2\pi npq}} e^{-(k-np)^2/2npq} \quad (1)$$

$$p+q=1$$

(a) if $k = 500$

then $k - np = 0$ and equation (1) yields

$$\begin{aligned} p_a &\simeq \frac{1}{\sqrt{2\pi npq}} \\ &= \frac{1}{10\sqrt{5\pi}} \\ &= 0.0252 \end{aligned}$$

(b) If $k = 510$

then $k - np = 10$ and equation (1) yields

$$\begin{aligned} p_b &\simeq \frac{e^{-0,2}}{10\sqrt{5\pi}} \\ &= 0.0207 \end{aligned}$$