Probability Assignment

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Find the probability of getting 5 twice in 7 throws of a dice. **Solution:** Let X be random variable defined as

Random Variable	Values	Description
X	$1 \le X \le 7$	Number of 5 appearing on dice

X has a binomial distribution with parameters

$$n = 7 \qquad p = \frac{1}{6} \tag{1}$$

Pmf of X for $1 \le k \le 7$ is

$$p_X(k) = {}^nC_k p^k (1-p)^{n-k} \tag{2}$$

Probability of getting 5 twice in 7 throws of a dice is given by:

$$p_X(2) = {}^7C_2 \left(\frac{1}{6}\right)^2 \left(1 - \frac{1}{6}\right)^{7-2} \tag{3}$$

$$= \frac{7!}{5!2!} \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^5 \tag{4}$$

$$= 21 \left(\frac{1}{36}\right)\left(\frac{3125}{7776}\right) \tag{5}$$

$$= 21 \left(\frac{3125}{279936}\right) \tag{6}$$

$$= 0.234 \tag{7}$$

Let Y be goussian variable

$$\mu = np \tag{8}$$

$$= \frac{7}{6} \tag{9}$$

$$\sigma^2 = np(1-p) \tag{10}$$

$$= \frac{35}{36} \tag{11}$$

Using Normal distribution at X=2.

$$Z = \frac{X - \mu}{\sigma} \tag{12}$$

$$= \frac{2 - \frac{7}{6}}{\sqrt{\frac{35}{36}}} \tag{13}$$

$$= 0.845 \tag{14}$$

For pdf calculation

$$f_Y(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{15}$$

From the plot, pmf is close to normal distribution

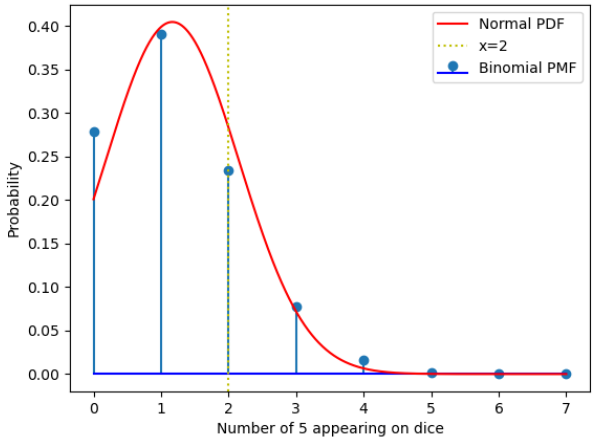

Fig. 0. Binomial pmf vs Gaussian pdf

pdf.

$$p_Y(2) = p_Z(0.845) \tag{16}$$

$$= 0.234 \tag{17}$$

From (7) and (17),

$$p_X(2) \approx p_Y(2) \tag{18}$$