Assignment 1
Ncert Exampler

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EE22BTECH11042

Question 9.3.13 Find the probability of getting 5 twice in 7 throws of a dice.

Solution:

let Y be a gaussian Random variable

Parameter	Value	Description
X	{0,1,2,3,4,5,6,7}	Number of 5 appearing on dice
n	7	Number of cards drawn
p	$\frac{1}{6}$	getting 5
q	$\frac{5}{6}$	getting any other number
$\mu = np$	$\frac{7}{6}$	Mean of Binomial distribution
$\sigma^2 = npq$	$\frac{35}{36}$	Varience of Binomial distribution

TABLE 0
Random variable and Parameter

$$Y \sim N(\mu, \sigma) \tag{1}$$
$$\sim N(1.166, 0.972) \tag{2}$$

Due to continuity correction $\Pr(X = x)$ can be approximated using gaussian distribution as

$$p_Y(x) \approx \Pr(x - 0.5 < Y < x + 0.5) \tag{3}$$
$$\approx \Pr(Y < x + 0.5) - \Pr(Y < x - 0.5) \tag{4}$$
$$\approx F_Y(x + 0.5) - F_Y(x - 0.5) \tag{5}$$

CDF of Y is defined as:

$$F_Y(x) = \Pr(Y < x) \tag{6}$$
$$= \Pr\left(\frac{Y - \mu}{\sigma} < \frac{x - \mu}{\sigma}\right) \tag{7}$$
$$\implies \frac{Y - \mu}{\sigma} \sim N(0, 1) \tag{8}$$
$$= 1 - \Pr\left(\frac{Y - \mu}{\sigma} > \frac{x - \mu}{\sigma}\right) \tag{9}$$
$$= \begin{cases} 1 - Q\left(\frac{x-\mu}{\sigma}\right) & x \geq \mu \\ Q\left(\frac{\mu - x}{\sigma}\right) & x < \mu \end{cases} \tag{10}$$

Then probability in terms of Q funtion is

$$\implies p_Y(x) \approx Q\left(\frac{(x - 0.5) - \mu}{\sigma}\right) - Q\left(\frac{(x + 0.5) - \mu}{\sigma}\right) \tag{11}$$

The Gaussian approximation for $\Pr(X = 2)$ is

$$p_Y(2) \approx Q\left(\frac{1.5 - 1.166}{0.972}\right) - Q\left(\frac{2.5 - 1.166}{0.972}\right) \tag{12}$$

$$\approx Q(0.343) - Q(1.371) \tag{13}$$

$$\approx 0.282 \tag{14}$$

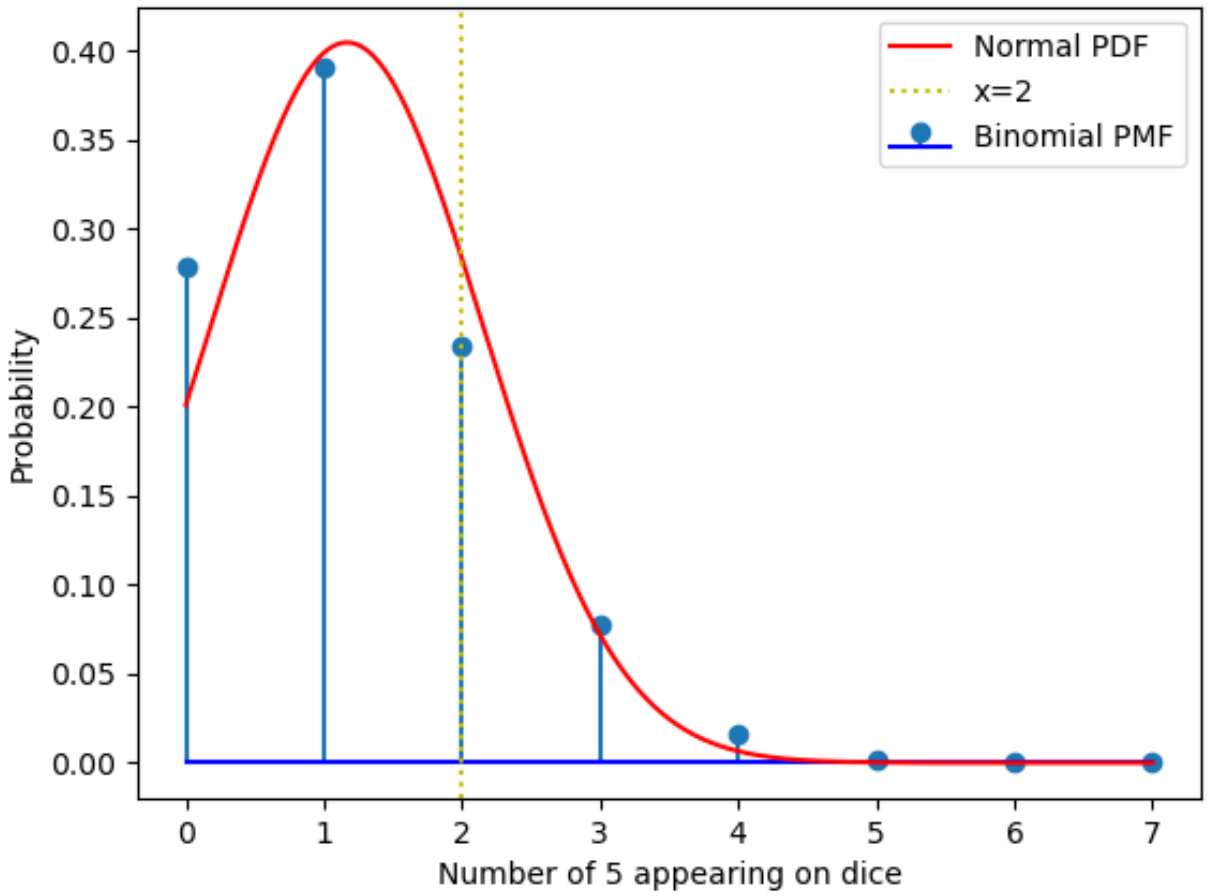

Fig. 0. Binomial and gaussian distribution