Assignment6

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Problem statement: Find the probability distribution of number of success in two tosses of die,where success is defined as

i number greater than 4

ii six appear on at-least one die

Solution: Let $X \in (1,2,3,4,5,6)$be the outcome of first throw
$Y \in (1,2,3,4,5,6)$ be the outcome of second throw

1 number greater than 4

Let Z be the number of times the number greater than 4 occurs
When we throw 2 dies,there can be three cases

1. no number greater than 4
2. one number greater than 4
3. both number greater than 4

so values of **Z** can be **0,1,2**

$$\begin{aligned} Pr(Z=0) &= Pr(X \leq 4) \& Pr(Y \leq 4) \\ &= \frac{4}{6} \times \frac{4}{6} \\ &= \frac{4}{9} \end{aligned}$$

$$\begin{aligned} Pr(Z=1) &= Pr(X > 4) \& Pr(Y \leq 4) + Pr(X \leq 4) \\ &\quad \& Pr(Y > 4) \\ &= \frac{2}{6} \times \frac{4}{6} + \frac{4}{6} \times \frac{2}{6} \\ &= \frac{4}{9} \end{aligned}$$

$$\begin{aligned} Pr(Z=2) &= Pr(X > 4) \& Pr(Y > 4) \\ &= \frac{2}{6} \times \frac{2}{6} \\ &= \frac{1}{9} \end{aligned}$$

X	0	1	2
Pr(X)	$\frac{4}{9}$	$\frac{4}{9}$	$\frac{1}{9}$

Table 1: **probability distribution**

2 six appear on at-least one die

since a pair of dies are thrown,
There can be two cases

1. six does not appear at all
2. six appear on atleast one die

Hence,
Z=0 six does not appears at all

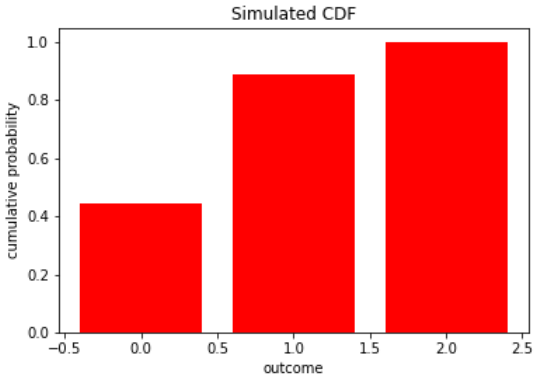

Figure 1: simulated CDF

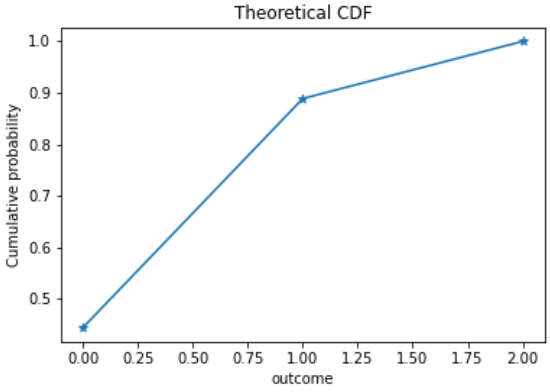

Figure 2: Theoretical CDF

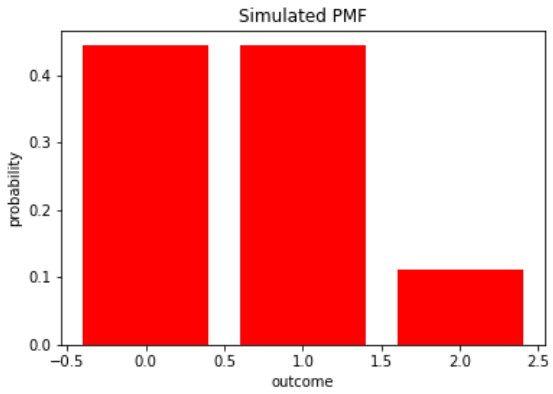

Figure 3: simulated PMF

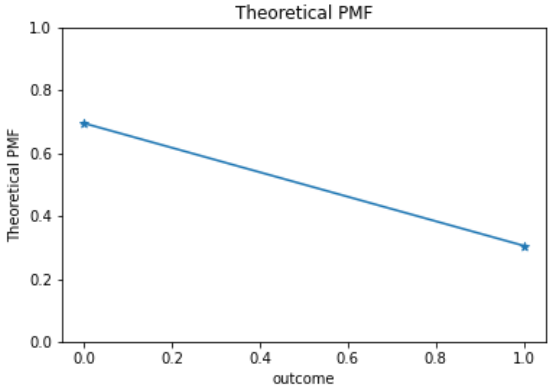

Figure 4: theoretical PMF

Z=1 appears on atleast die

Finding P(Z=1)

ie,probability that at-least one six appears

$$\begin{aligned} Pr(Z=1) &= Pr(X=6)\&Pr(Y<6) + Pr(X<6) \\ &\quad \&Pr(Z=6) + P(X=6)\&P(Y=6) \\ &= \frac{1}{6}\times\frac{5}{6} + \frac{5}{6}\times\frac{1}{6} + \frac{1}{6}\times\frac{1}{6} \\ &= \frac{11}{36} \end{aligned}$$

Finding P(Z=0)

i.e,probability that six does-not appear

$$\begin{aligned} Pr(Z=0) &= Pr(X<6)\&Pr(Y<6) \\ &= \frac{5}{6}\times\frac{5}{6} \\ &= \frac{25}{36} \end{aligned}$$

Therefore,Pr(X=0)=$\frac{25}{36}$ so,our probability distribution is

X	0	1
P(X)	$\frac{25}{36}$	$\frac{11}{36}$

Table 2: probability distribution

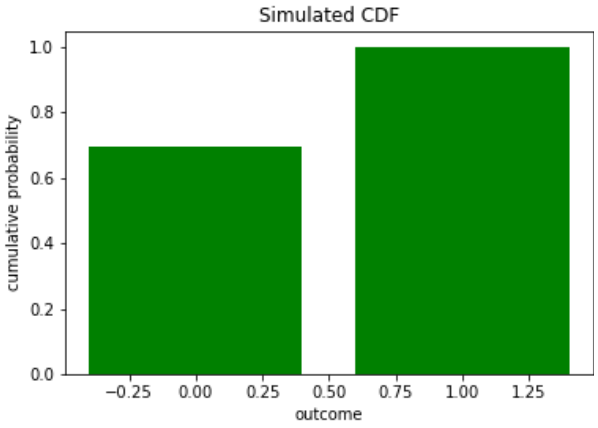

Figure 5: simulated CDF

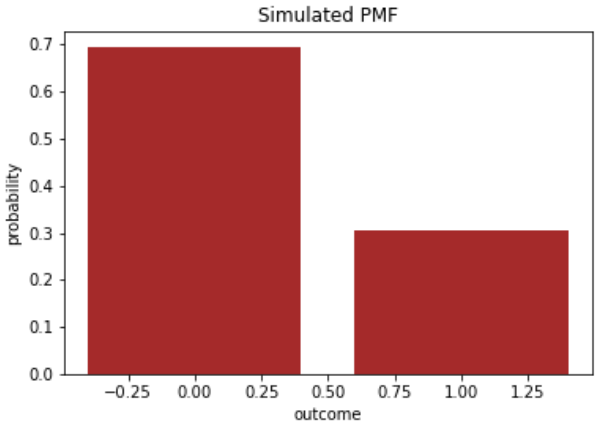

Figure 7: simulated PMF

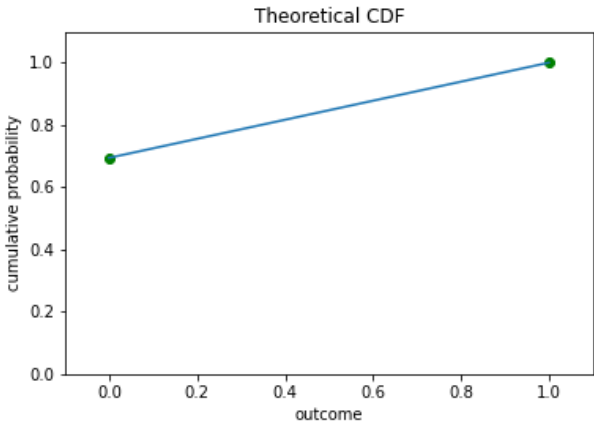

Figure 6: Theoretical CDF

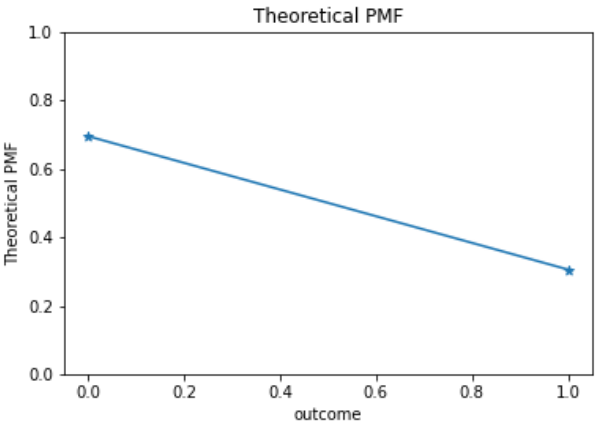

Figure 8: theoretical PMF