Exit Polls
Opinion Polls } Inferential stats

Bag → 3 red ⇒ 150 Rs
2 blue

⇓

4 Red Balls

⇒ 10 Rs ← stud pay

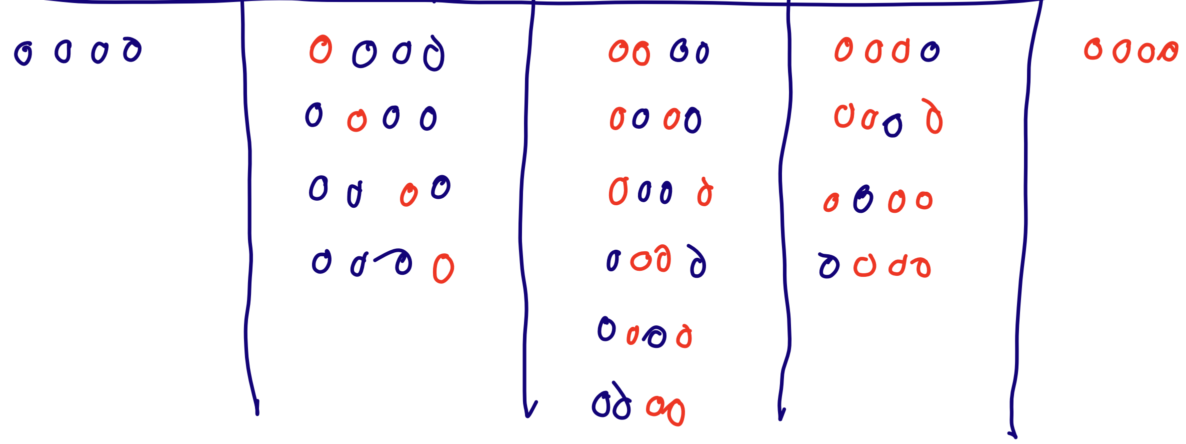
1. Find all possible combinations

2. Find prob of each combination

3. Use prob to estimate profit / loss

Possible outcomes

4 Blue 0 Red	3 Blue 1 Red	2 Red 2 Blue	1 Blue 3 red	0 Blue 4 Red



X → Number of Red balls

→ X = 3 → Random variable

→ X = 2

Cust id	Income	Loan	Dependent	Default
—	—	—	—	Yes
—	—	—	—	No
—	—	—	—	No

X = 1 ⇒ if defaulted

X = 0 ⇒ if not default

X = 0	X = 1	X = 2	X = 3	X = 4
4 Blue 0 Red	3 Blue 1 Red	2 Red 2 Blue	1 Blue 3 red	0 Blue 4 Red

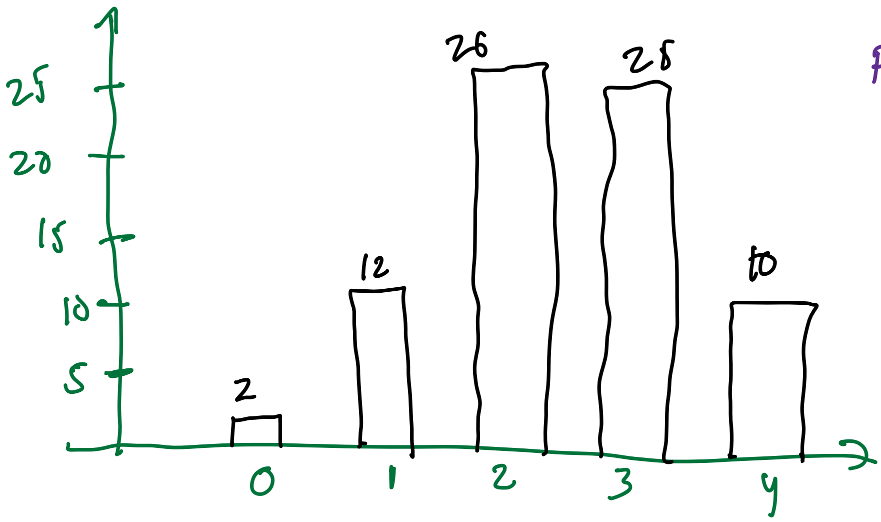
$x=0 \Rightarrow 2$

$x=1 \Rightarrow 12$

$x=2 \Rightarrow 26$

$x=3 \Rightarrow 25$

$x=4 \Rightarrow 10$

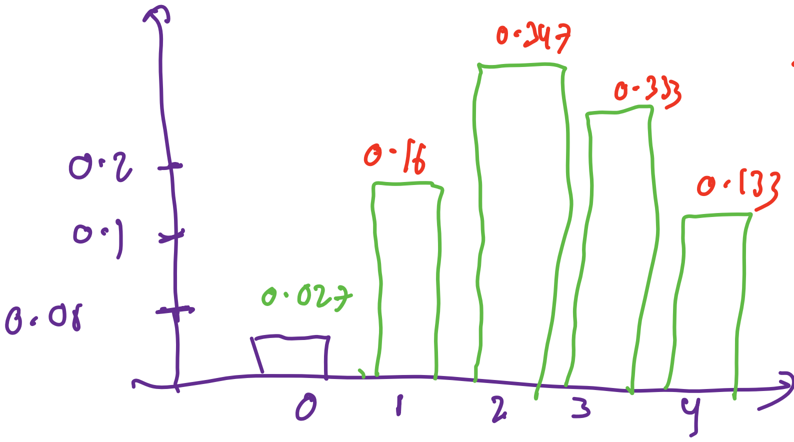


$P(x=2) = \frac{26}{75}$

$P(x=4) = \frac{10}{75}$

x	Prob
0	0.027
1	0.16
2	0.347
3	0.333
4	0.133

$\Rightarrow$ Prob. Distribution



→ Prob distribution chart

$P(x=1) = 0.16$

Total Players = 1000

Number of players with 1 red ball = 160

$P(x=2) = 0.347$

= 347

$x=0 = 27$

$x=1 = 160$

$x=2 = 347$

$x=3 = 333$

$x=4 = 133$

$27*0 + 160*1 + 347*2 + 333*3 + 133*4$

Total # of red balls = 2385

Avg # red balls $\Rightarrow$ 2.385

$\Rightarrow$ $X = x_1, x_2, x_3, x_4, x_5, \ldots, x_n$

$EV = x_1 * P(x = x_1) + x_2 * P(x = x_2) +$
$x_3 * P(x = x_3) + \ldots$
$x_n * P(x = x_n)$

$= 0 * 0.027 + 1 * 0.16 + 2 * 0.347$
$+ 3 * 0.333 + 4 * 0.133$
$= 2.385$

$X \rightarrow +150, -10$

$P(x = 150) = P(4 \text{ red balls}) = 0.133$

$P(x = -10) = P(0 \text{ OR } 1 \text{ OR } 2 \text{ OR } 3 \text{ red balls})$
$= 0.027 + 0.160 + 0.347$
$+ 0.333$
$= 0.867$

$EV = x_1 * P(x = x_1) + x_2 * P(x = x_2) +$
$x_3 * P(x = x_3) + \ldots$
$x_n * P(x = x_n)$

$EV = 150 * 0.133 + (-10) * 0.867$
$= 11.28$

Without Experiment

3 red Balls
2 Blue Balls

$P($1 Red ball in 1 trial$) = \frac{3}{5} = 0.6$

$P(E_1 \text{ AND } E_2) = P(E_1) * P(E_2)$

P(2 red balls in 2 trials)

P(red in 1st trial) && P(red in 2nd trial)
$= 0.6 * 0.6$
$= 0.36$

Q) 2 Blue 3 red Balls

O O O O

$0.4 * 0.6 * 0.6 * 0.6$

$2/5 = B$
$3/5 = R$

$\Theta \Rightarrow \quad X = 3$

$P(0000) \Rightarrow 0.4 * 0.6 * 0.6 * 0.6$

$\Rightarrow 0.0864$

$P(0000) = 0.6 * 0.4 * 0.6 * 0.6$

$= 0.0864$

$P(0000) = 0.0864$

$P(0000) = 0.0864$

$P(X=3) = 4 * 0.0864$

$= 0.3456$

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$P(X=0) = 0000 \Rightarrow 0.4 * 0.4 * 0.4 * 0.4$

$\Rightarrow 0.0256 * 1$

1 2
00 00
2 1
00 00

X=0 4 Blue 0 Red	X=1 3 Blue 1 Red	X=2 2 Red 2 Blue	X=3 1 Blue 3 red	X=4 0 Blue 4 Red
0000	0000	0000	0000	0000
	0000	0000	0000	
	0000	0000	0000	
	0000	0000	0000	
		0000		
		0000		

$P(X=1) = 0000$

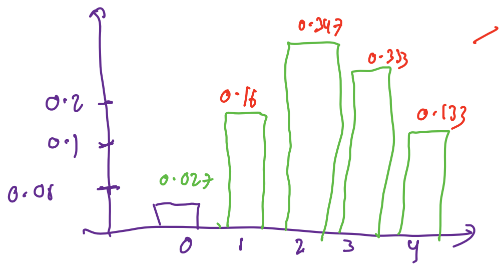
$= 0.6 * 0.4 * 0.4 * 0.4$

$= 0.0384$

$\Rightarrow 4 * 0.0384 = 0.1536$

$P(X=4) = (0.6)^4 = 0.1296$

With Experiment



Binomial Distribution

$P(X=4) = 0\ 0\ 0\ 0 \Rightarrow p * p * p * p$

$P(R) = p$

$P(B) = 1-p$

$P(X=3) = ? * (p) * (p) * (p) * (1-p)$

$= 4p^3 * (1-p)$

$P(X = r)$

$$\underbrace{o\ o\,o\,o\,o\,o\ \ldots}_{r \text{ red balls}} \quad \underbrace{o\,o\,o\,o\,o}_{n-r}$$

$$= (p)^r * (1-p)^{n-r}$$

total # of $\Rightarrow$ ${}^nC_r$

$$\boxed{P(x=r) = {}^nC_r\,(p)^r\,(1-p)^{n-r}}$$

X	$P(X=x)$
0	${}^nC_0\,(p)^0\,(1-p)^n$
1	${}^nC_1\,(p)^1\,(1-p)^{n-1}$
⋮	
n	${}^nC_n\,(p)^n\,(1-p)^0$

$$P(x \le 1) = P(x=0) + P(x=1)$$

x	Prob	$F(x) = P(x \le x)$

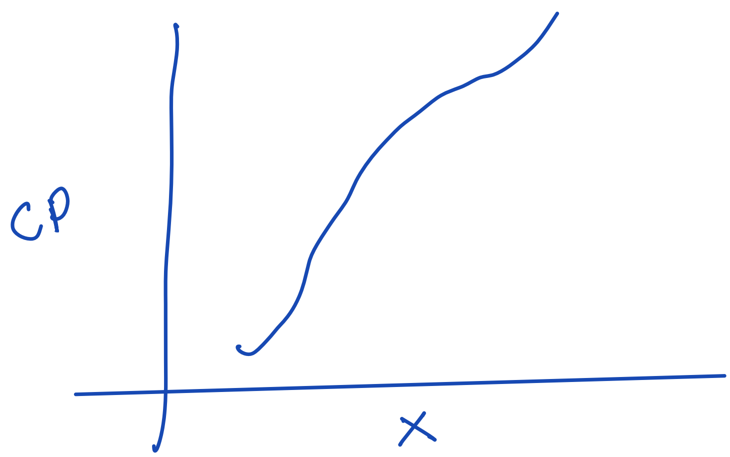
→ CDF

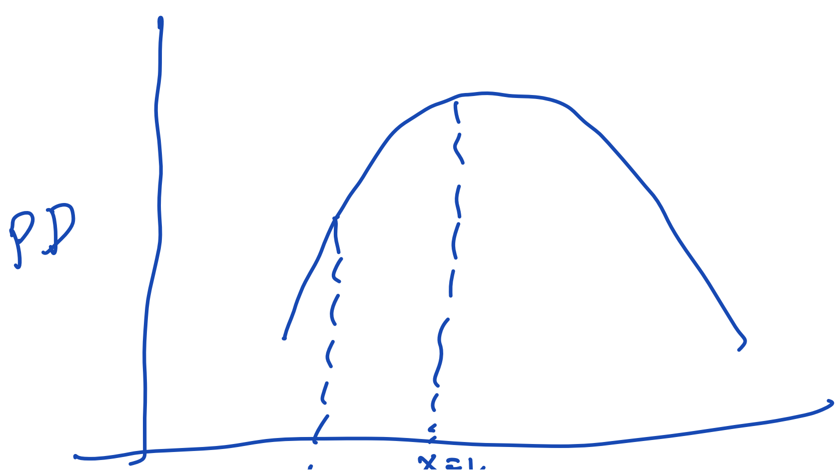
0	0.027	0.027
1	0.16	0.187
2	0.347	0.554
3	0.333	0.887
4	0.133	1

PDF

shivank.agrawal_1 @ scaler.com

Cumulative Dist func





$X=1 \quad x$

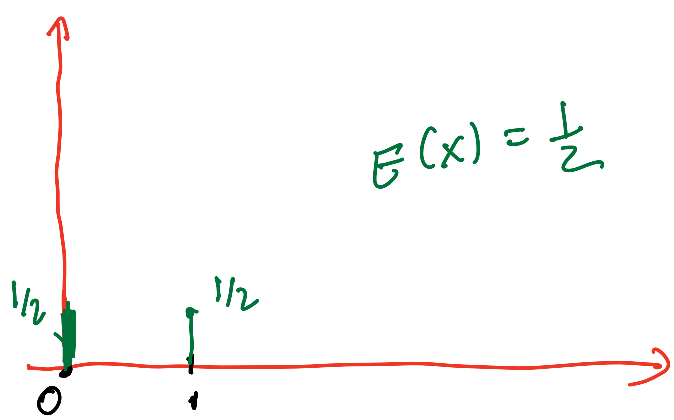
$X=1 \quad \& \quad y=2$

Coin: $\{H, T\}$
$H \downarrow 0, \quad T \downarrow 1$

$EV = x_1 * P(x=x_1) + x_2 * P(x=x_2) +$
$x_3 * P(x=x_3) + \ldots -$
$x_n * P(x=x_n)$

$\Rightarrow 0 * \frac{1}{2} + 1 * \frac{1}{2} = \frac{1}{2}$

PMF

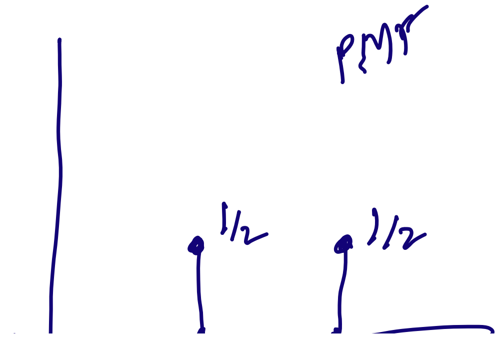


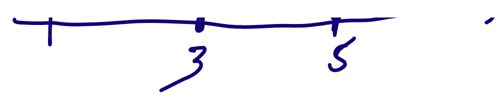
$E(x) = \frac{1}{2}$

(2) $\{H, T\}$
$H \downarrow 3, \quad T \downarrow 5$

$3 * \frac{1}{2} + 5 * \frac{1}{2} = 4$

PMF





$y = 2x + 3$

① $x = 0 \Rightarrow y = 2 * 0 + 3 = 3$

② $x = 1 \Rightarrow y = 2 * 1 + 3 = 5$

$$E[y] = 2E[x] + 3$$
$$= 2 * \frac{1}{2} + 3 = 4$$

$$E[ax + b] = aE[x] + b$$
$$E[2x + 3] = 2E[x] + 3$$

Properties

① $E[aX + b] = aE[X] + b$

② $E[X + Y] = E[X] + E[Y]$

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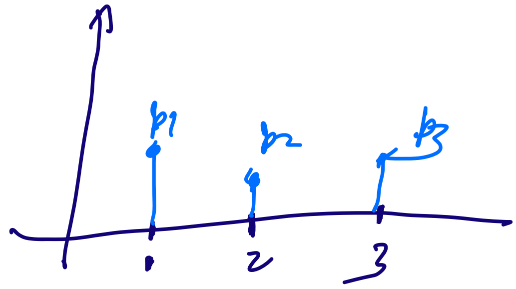
$\Rightarrow$ x.

w

$$\frac{\sum (x_i - \mu)^2}{N}$$

$X = \{1, 2, 3\}$
$\quad\;\; p_1 \;\; p_2 \;\; p_3$



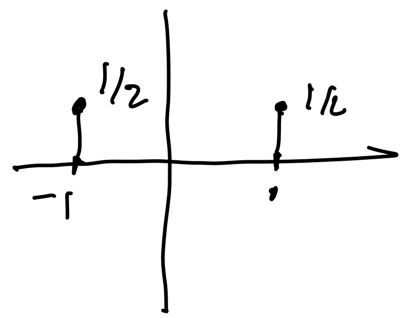
$x^2 = \{1, 4, 9\}$

$\{X = 2\} \longleftrightarrow \{x^2 = 4\}$

$E[X] = (1)p_1 + (2)p_2 + (3)p_3$

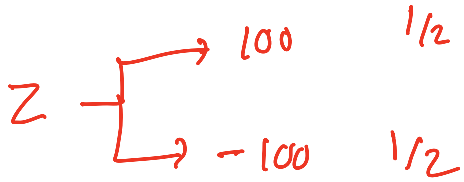
$E(X^2] = (1)p_1 + (4)p_2 + (9)p_3$

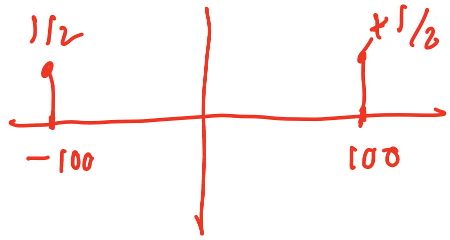
$$Y \begin{cases} \to 1 & 1/2 \\ \to -1 & 1/2 \end{cases}$$



$$E[Y] = \frac{1}{2}(-1) + \frac{1}{2}(1) = 0$$

$$E[Y^2] = \frac{1}{2}(-1)^2 + \frac{1}{2}(1)^2 = 1$$



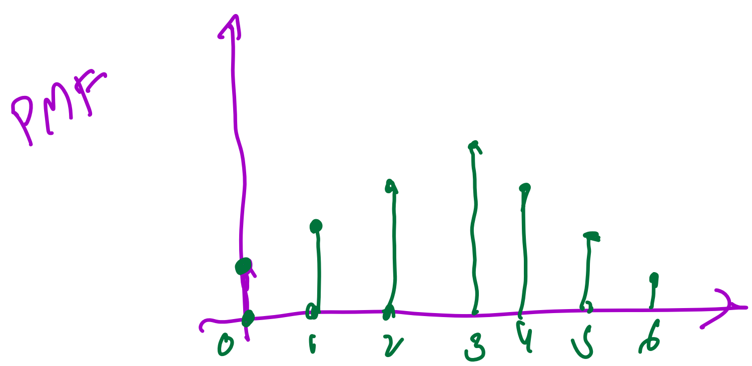


$$E[Z] = \frac{1}{2}(-100) + \frac{1}{2}(100) = 0$$

$$E[Z^2] = \frac{1}{2}(-100)^2 + \frac{1}{2}(100)^2$$

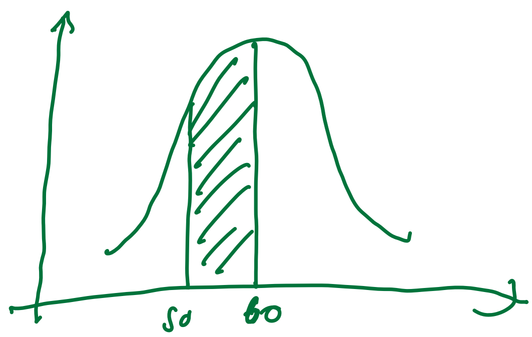
$$= 10K$$

$$\{Y^2 = 1\} = \{Y = 1\} \cup \{Y = -1\}$$



Number of goals in a football game

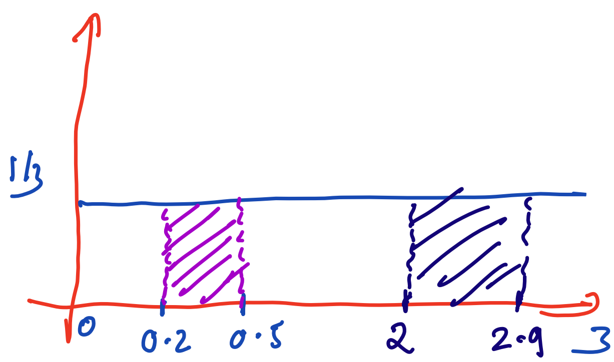
Waiting time for swiggy / zomato :



Q ⇒ There is a rod of 3 mt. And I hit at that rod

$\frac{1}{3}$ (0.3)

= 0.1



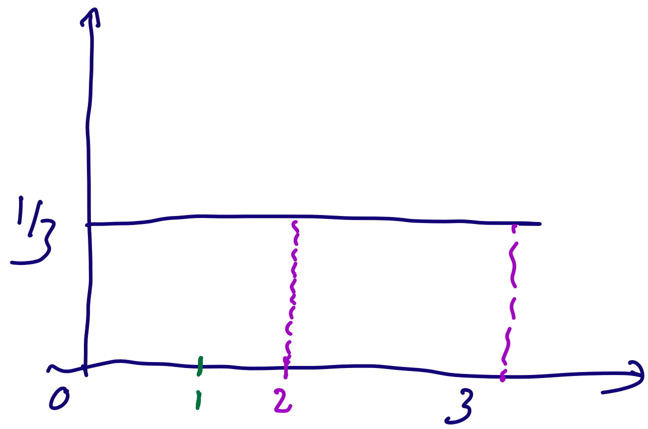
$P[2 \le x \le 2.9] = \frac{1}{3} * (0.9)$

$= 0.3$

$F[2] = P[x \le 2]$

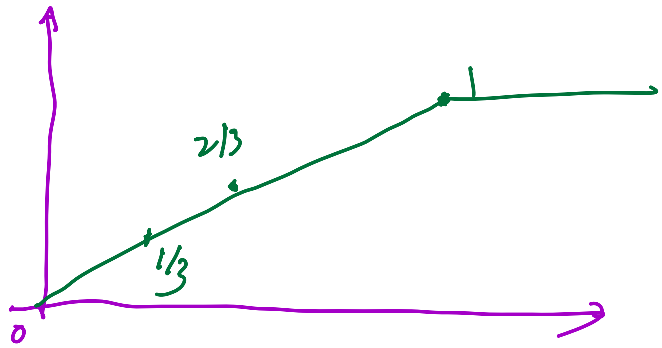
$= P[0,2]$

$\Rightarrow 2/3$

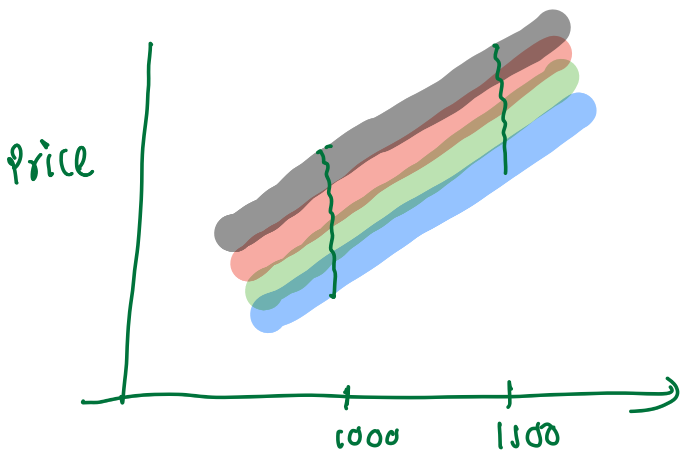


$F(3) = 1$

CDF



$E[x] \Rightarrow$ mean weighted



$E[x \mid sq = 1000]$

$E[x \mid sq = 1500]$

Variance :

$$(x - \mu)^2$$

Sehwag

300+ ⇒ 2 times

< 10 scores → ↑

Dravid

$\mu = 50$

$\mu = 50$

$|x - \mu|^2$ squared

0	45
300	50
100	60
$\|0 - 50\|^2$	$\|45 - 50\|^2$
$\|300 - 50\|^2$	$\|50 - 50\|^2$
$\|100 - 50\|^2$	$\|60 - 50\|^2$

$E[ax + b] = aE[x] + b$

$E[b] = b$

$$E(x - \mu)^2$$

$$Var[x] = E(x - \mu)^2$$

$$= E[x^2 + \mu^2 - 2\mu x]$$

$$= E[x^2] + E[\mu^2] - 2\mu E[x]$$

$$= E[x^2] + \mu^2 - 2\mu \cdot \mu$$

$$= E[x^2] - \mu^2$$

$$\boxed{Var(X) = E[x^2] - (E[X])^2}$$

a b c $\quad 2^3 = 8$

$\frac{1}{8} \leftarrow HHH \rightarrow \frac{1}{2} * \frac{1}{2} * \frac{1}{2}$

HH7 $\quad = \frac{1}{8}$