

Prob. of events, eg $P(A)$

Prob. of complex events, eg $P(A \cap B)$

Random Variable.

{ Categorical
X is the color of the student
that enters the door next.
{X = Red} {X = Blue}

Quantitative { Generic Distribution.
Special Distribution.

Generic Distribution.

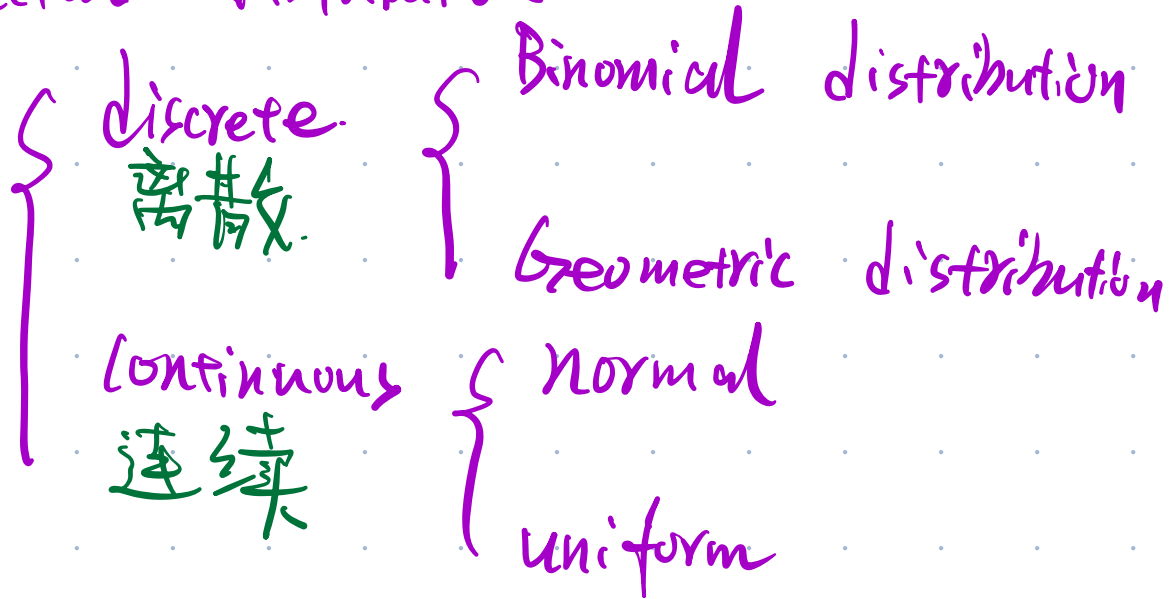
X	0	1	2	3
$P(X=i)$	0.2	0.3	0.1	0.4

$$P(X \leq 1) = \frac{\text{Area}(\{X \leq 1\})}{\text{Area}(S)}$$

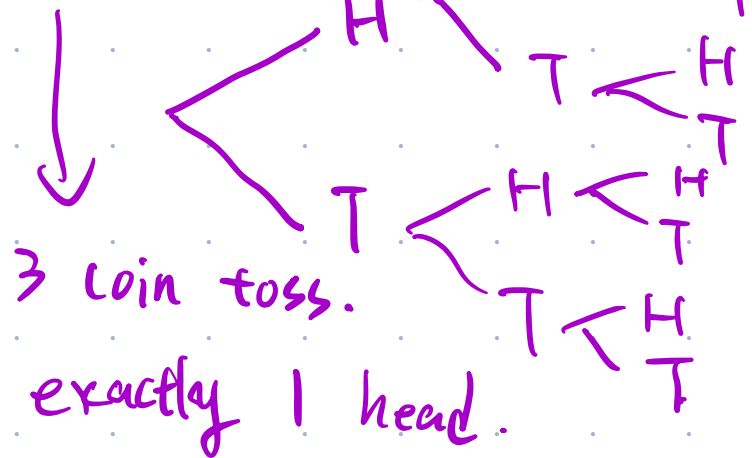
$$= \frac{0.2 + 0.3}{1} = 0.5$$

Similar to categorical variable & prob. of events.

Special Distribution



eg 1.



HHH	
HHT	
HTH	
HIT	✓
THH	
THT	✓
TTH	✓
TTT	

} 3

$$P(1 \text{ head}) = \frac{3}{8}$$

↑
total
of
outcomes

Binomial Settings (Remember!!!)

- 1) fixed number of trials n
- 2) only 2 outcomes each trial
success or failure.
define yourself
- 3) fixed success prob. p .
- 4) independent trials.

X represent the number of success in n trials

Binomial formula. ↙ Binomial PDF.

PDF

$$P(X=k) = \binom{n}{k} p^k (1-p)^{n-k}$$

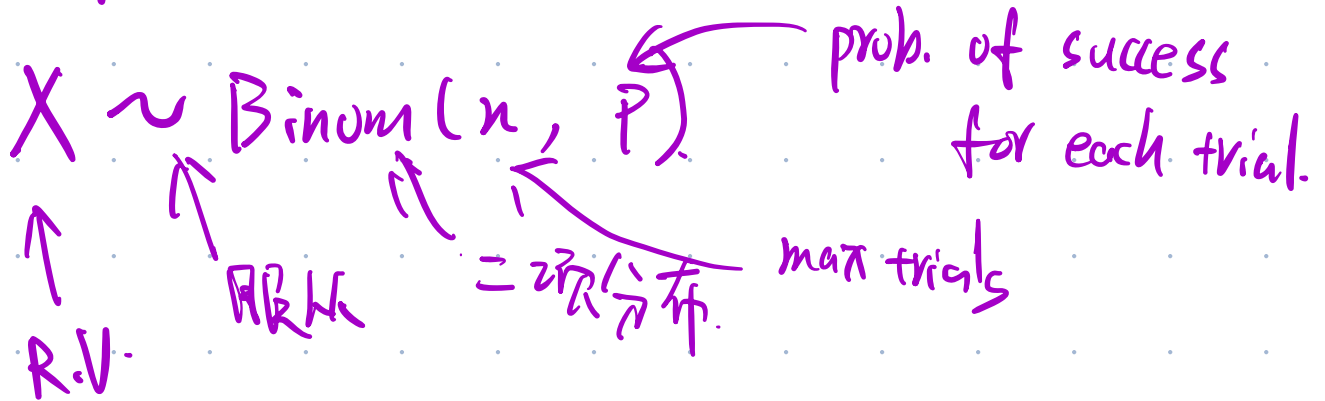
eg 2. $P(X=2) = \binom{5}{2} 0.2^2 (1-0.2)^3$

$$\binom{5}{2} = {}^5C_2 = \frac{5!}{2!(5-2)!}$$

$$\binom{n}{k} = {}^nC_k = \frac{n!}{k!(n-k)!}$$

Binomial CDF.

$$P(X \leq k) = P(X=0) + P(X=1) + \dots + P(X=k)$$



$$E(X) = \mu_x = np$$

↑ expected value

↑ mean of x

$$\text{Std}(X) = \sigma_X = \sqrt{np(1-p)}$$

$\uparrow$
 std. of X .

当 $p \rightarrow 0.5$. $X \rightarrow \text{symmetric}$

当 $np \geq 10$, $n(1-p) \geq 10$ 时. $X \rightarrow \text{Binom} \rightarrow \text{Normal}$

当 $p \rightarrow 0$ 时. 且 $np < 10$ 时. 左截断
 skew to the right.



当 $p \rightarrow 1$ 时, 且 $n(1-p) < 10$ 时, 右截断.

Skew to the left



$X \sim \text{Geometric}(p)$. ^{几何分布}

X 是多次实验, 第一次成功的次数.

用计算机算 $\left\{ \begin{aligned} P(X=k) &= (1-p)^{k-1} p \leftarrow \text{PDF.} \end{aligned} \right.$

$P(X \leq k) = P(X=1) + P(X=2) + \dots + P(X=k)$.

first, until.

$$E(X) = \frac{1}{p}$$

Expected value

$$\text{Std}(X) = \sqrt{\frac{1-p}{p^2}}$$

only skew to right

