

## Hypothesis testing (item)

$X \sim \text{Bin}(n, \theta)$

$$H_0: \theta = \theta_0$$

$$H_1: \theta > \theta_0$$

Coin

Z.V.

Observe: number of heads  $\leftrightarrow X$

$$P[X = k | H_0] = \binom{n}{k} \left(\frac{1}{2}\right)^k \left(1 - \frac{1}{2}\right)^{n-k}$$

realization (what we saw)

$$100 \rightarrow m_1, S_1 \leftarrow m_0$$

$$101 \rightarrow m_2, S_2 \leftarrow m < m_0$$

$E, \text{Var}$



Random forest

Prob. Theory

linear  
alg. calc.

Linear  
regression

$$A \perp\!\!\!\perp B \Leftrightarrow \text{indep.} \quad \text{IP}[AB] = \text{IP}[A]\text{IP}[B]$$

$$\boxed{\text{IP}[AB] = \text{IP}[A|B]\text{IP}[B]}$$

(2.30)  $E_1 = A > B, E_2 = A > C$

$$E_1 \xrightarrow{} E_2$$

$$A_{B,C} \sim U[1, \dots, n]$$

$$(a, b, c) \in \{1, \dots, n\}^3$$

$$\boxed{\text{IP}[A=k | B=l] = \text{IP}[A=k]}$$

$$\text{IP}[A \geq c | A > B] \neq \text{IP}[A \geq c]$$

$$\begin{array}{c} \uparrow \\ \boxed{A \geq B \geq C} \\ \downarrow \\ \boxed{A > C > B} \end{array} \quad F_1, F_2$$

$$A > C = \{F_1, F_2, F_3\}$$

$$B > A \geq C \quad F_3$$

$$A > B = \{F_1, F_2, F_5\}$$

$$B \geq C > A$$

$$\begin{array}{c} F_4 \\ F_5 \\ F_6 \end{array}$$

$$\begin{array}{c} \uparrow \\ \boxed{C \geq A > B} \\ \downarrow \\ \boxed{C > B \geq A} \end{array}$$

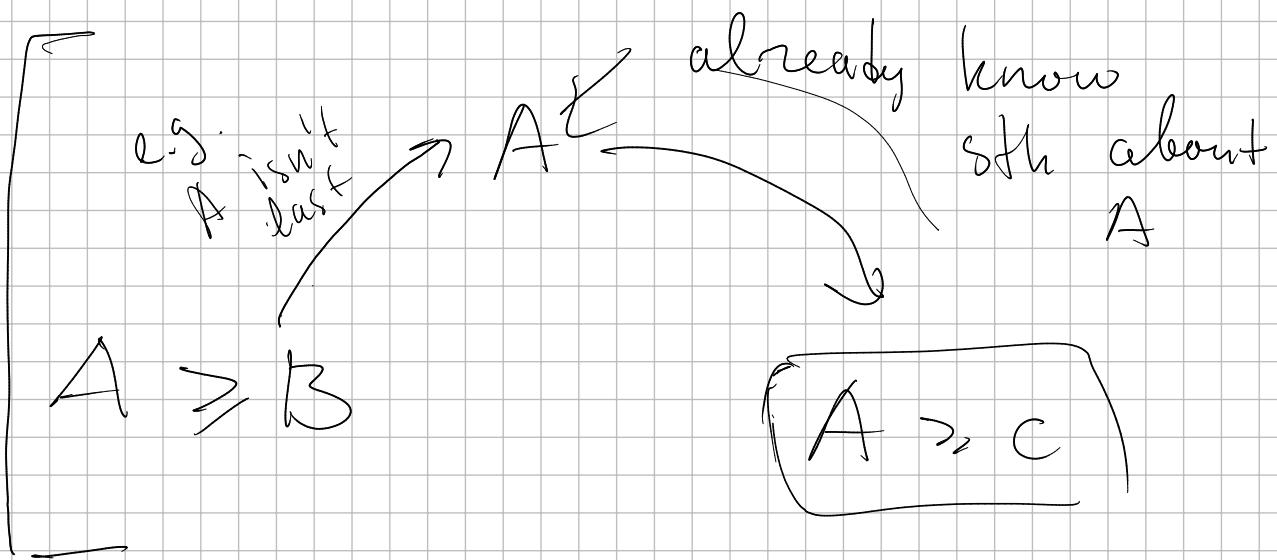
$$\text{IP}[\{F_1, F_2\}] = \frac{2}{3}$$

$$\text{IP}[F_1] = \frac{1}{6}$$

$$P[A_1, C | \overline{A_2, B}] = \frac{P[A_1, C, A_2, B]}{P[A_2, B]} =$$

$$= \frac{P[\{F_1, F_2\}]}{P[\{F_1, F_2, F_3\}]} = \frac{\frac{2}{6}}{\frac{3}{6}} = \frac{2}{3}$$

$$P[A_1, C] = P[\{F_1, F_2, F_3\}] = \frac{3}{6} = \frac{1}{2}$$



$\nexists$  w/o knowledge about  $A$

$$P[A \cap \overline{A}] = P[A] P[\overline{A}]$$

$$\overbrace{P[A]}^x = \overbrace{P[A]}^x \overbrace{P[\overline{A}]}^x$$

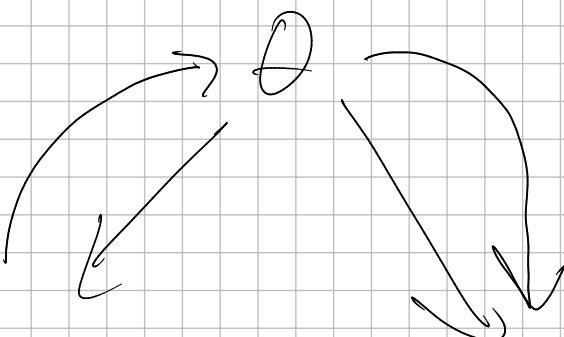
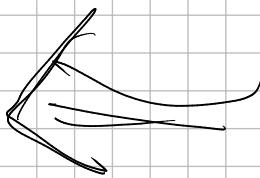
$$\boxed{x = x^2} \Rightarrow \boxed{x = 1}, x = 0$$

$$x(x-1) = 0$$

$$P[A] = 0$$

~~A~~ holds only in  
 $A = \emptyset$  discrete  
 $A = \Omega$  space

$$P[A] = 1$$



~~X~~  $\sim \text{Bin}(m; \theta)$

$Y \sim \text{Bin}(n, \theta^2)$