

Hypothesis testing (demo)

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

$$H_0: \theta = \theta_0$$

$$H_1: \theta > \theta_0$$

Coin

Observe: number of heads $\leftrightarrow X$

z.v.
 \downarrow

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

\uparrow
realization (what we saw)

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

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

\mathbb{E}, Var



Random forest

Prob. theory \downarrow Linear
als. Calc. \downarrow Linear regression

indep.

$$A \perp B \Leftrightarrow P[AB] = P[A]P[B]$$

$$P[AB] = P[A|B]P[B]$$

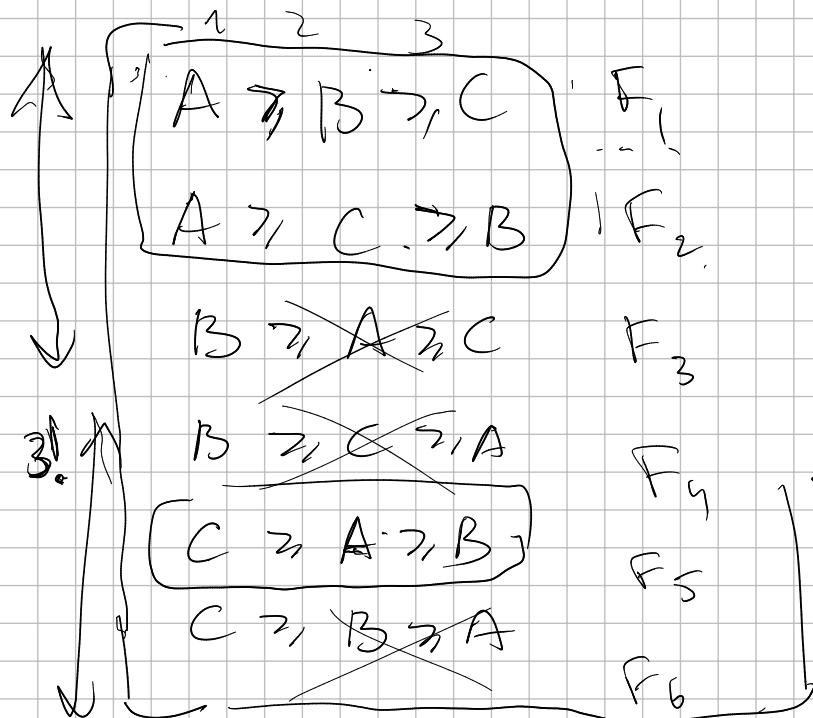
2.30 $E_1 = A \supset B, E_2 = A \supset C$

$$E_1 \rightarrow E_2$$

$$A, B, C \sim U_{h_1, \dots, h_y} \quad (a, b, c) \in \{1, \dots, h_y\}^3$$

$$P[A=k | B=l] = P[A=k]$$

$$P[A \supset C | A \supset B] \neq P[A \supset C]$$



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

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

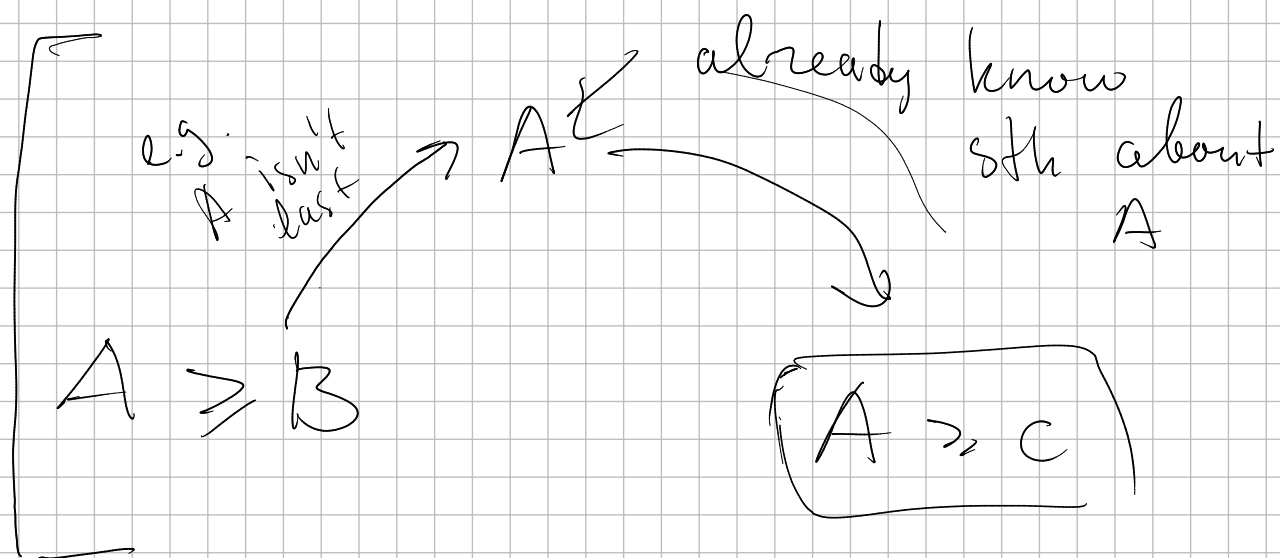
$$P[\{F_1, F_2\}] = \frac{2}{3}$$

$$P[F_i] = \frac{1}{6}$$

$$P[A \supset C | A \supset B] = \frac{P[A \supset C, A \supset B]}{P[A \supset B]}$$

$$= \frac{P[\{F_1, F_2\}]}{P[\{F_1, F_2, F_5\}]} = \frac{\frac{2}{6}}{\frac{3}{6}} = \frac{2}{3}$$

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



\neq w/o knowledge about A

$$A \perp A \Leftrightarrow P[A \cap A] = P[A] P[A]$$

$$P[A] = P[A] P[A]$$

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

$$x = x^2 \Rightarrow x = 1, x = 0$$

$$P[A] = 0$$

$$P[A] = 1$$

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

