AMS131
29 Jun 18

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this time: permutations & combinatorics;
next time: conditional probability, Bayes's Theorem

read: DS. Ch. 1, 2 ←

Quiz 1 due at canvas tonight by 11.59pm today

extra notes pp. 28 →

P(H on 1 flip of a coin I found on the sidewalk | $\mathcal{B}$) = ?

= undefined until I assume the coin is "fair"; $P(H \mid \text{fair}) = \frac{1}{2}$

C1 = 1st card club
D2 = 2nd card diamond

quiz 1 (d) (ii)

$P(\text{win}) = P(C1 \text{ or } D2)$

$= P(C1) + \boxed{P(D2)}$

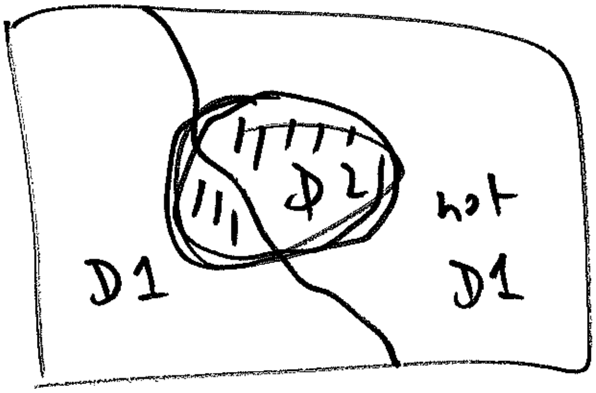
$- P(C1 \text{ and } D2)$

$P(D2) = ?$

hard because D2 depends on 1st draw

solution: (DV Lindley) let's introduce the outcome of 1st card into the conversation

$$P(D2) = P(D2 \text{ and } D1) + P(D2 \text{ and not } D1)$$



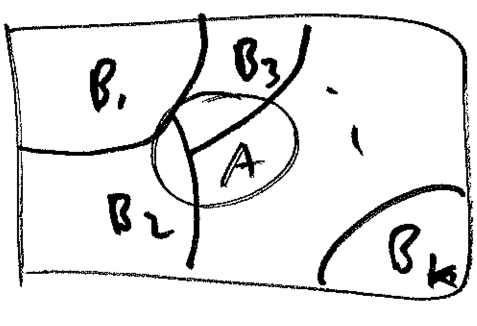
$$P(D2) = P[(D2 \text{ and } D1) \text{ or } (D2 \text{ and not } D1)]$$

$$\overset{\text{no overlap}}{=} P(D2 \text{ and } D1) + P(D2 \text{ and not } D1)$$

$$= P(D1)\,P(D2 \mid D1) + P(\text{not } D1)\,P(D2 \mid \underline{\underline{\text{not } D1}})$$

$$= \frac{1}{4} \cdot \frac{12}{51} + \frac{3}{4} \cdot \frac{13}{51}$$

$$= \frac{12 + 39}{4 \cdot 51} = \frac{51}{4 \cdot 51} = \frac{1}{4}$$



$$P(A) = P(B_1) \cdot P(A \mid B_1)$$

$$+ P(B_2) \cdot P(A \mid B_2)$$

$$+ \dots + P(B_k) \cdot P(A \mid B_k)$$

$$= \sum_{j=1}^{k} P(B_j) \cdot P(A \mid B_j)$$

cause $\overset{?}{\to}$ effect

C E

$P(E \mid C)$ $P(C \mid E)$

easier harder

cause$_1$ $\overset{?}{\searrow}$

cause$_2$ $\overset{?}{\to}$ effect

⋮ $\overset{?}{\nearrow}$

cause$_k$

$$P(C \mid E) \overset{?}{=} P(E \mid C)$$

$$P(C \mid E) = \frac{P(C \text{ and } E)}{P(E)} \qquad P(E \mid C) = \frac{P(E \text{ and } C)}{P(C)}$$

$$P(C \text{ and } E) = P(E)\,P(C \mid E)$$

$$P(E \text{ and } C) = P(C) \cdot P(E \mid C)$$

So ~~$P(E \mid C) = P(E)\,P(C \mid E)$~~

$$\boxed{P(C \mid E) = \frac{P(C)\,P(E \mid C)}{P(E)}}$$

Bayes's Theorem for T/F prop