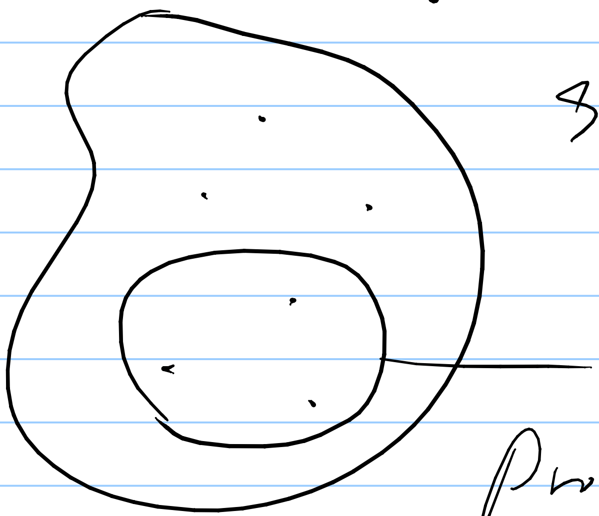
Sample space

sample points



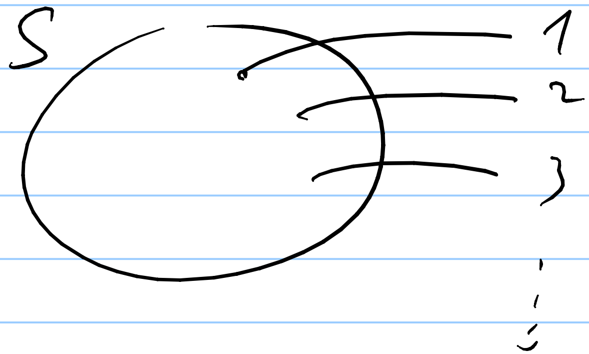
Event

Prob axioms

1. $P(A) \geq 0$
2. $P(S) = 1$
3. $P(A \cup B) = P(A) + P(B)$, $A \cap B = \phi$

$$P(A \cup B \cup C) = P(A) + P(B) + P(C)$$

Finite additivity $\Rightarrow$ Countable additivity



$\underline{a_1, \dots, a_n}$ finite

$a_1, a_2, a_3, \dots$ Countably infinit

$A_1, A_2, \dots$ $\quad A_i \cap A_j \neq \phi$

$i \neq j$

$$P\left(\bigcup_{i=1}^{\infty} A_i\right) = \sum_{i=1}^{\infty} P(A_i)$$

3 coins observe # heads

$\cancel{S} = \{A_0, A_1, A_2, A_3\}$

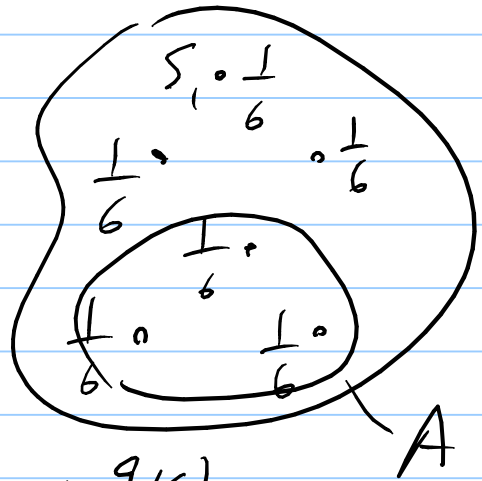
$S = \{hhh, hht, \ldots, ttt\}$

$A_2 = \{hht, hth, thh\}$

$S = [0, \infty) \qquad A = [3, 4]$

P : a set fun $\quad P(A) = \frac{1}{2}$ — prob allocation function

$$q(s) \geq 0 \qquad \sum_{S} q(s_i) = 1$$



$$q(s_1) = \frac{1}{6},\ q(s_2) = \frac{1}{6},\ \ldots$$

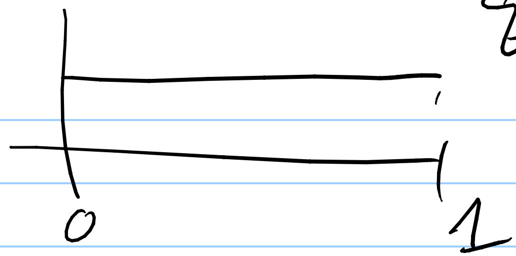
$$\sum_{A} q(s_i) = P(A)$$

$$q(s) \geq 0 \qquad \int_S q(s)\,ds = 1$$

$$\int_A q(s)\,ds = P(A)$$

A

$q(s) = 1$



n $\quad$ #h $\quad$ n_h $\quad$ $\frac{n_h}{n}$ = Relative frequency

$$\Downarrow$$

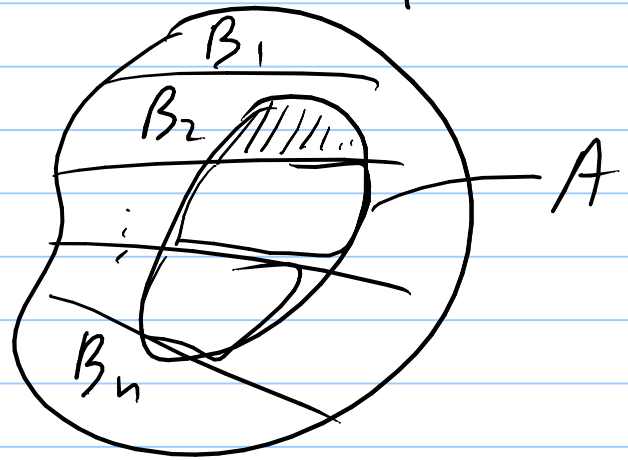
$$\boxed{\text{Prob}}$$

a priori prob

a posteriori prob

$$\boxed{A} \longrightarrow \boxed{B}$$

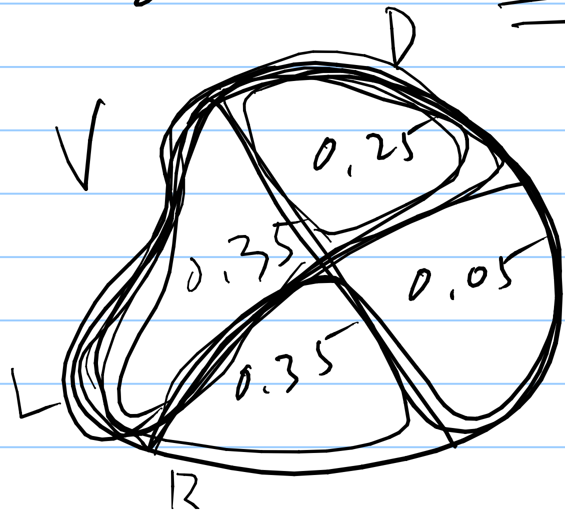
Thm 1.8 S $\{B_1, \cdots, B_n\}$



$$P(A) = \sum_{i=1}^{n} P(A \cap B_i)$$

$$P(VL) = P(V \cap L)$$

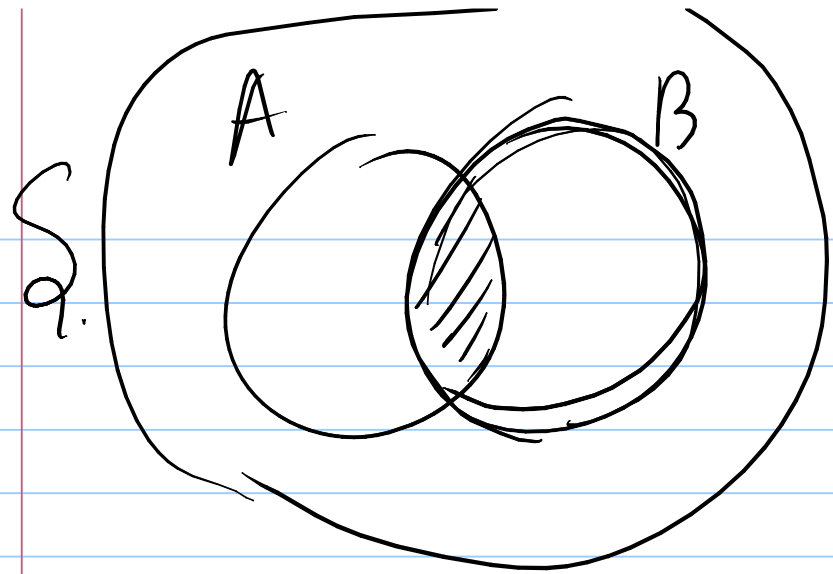
Quiz 1.4 $\underline{\underline{V \ D}} \ \underline{\underline{L \ B}}$



$P(V) = 0.7$
$P(L) = 0.6$
$P(VL) = 0.35$

$P(DUL) = ?0.65$

$P(LB) = 0 \quad \phi \quad P(VUB) = 0.75$

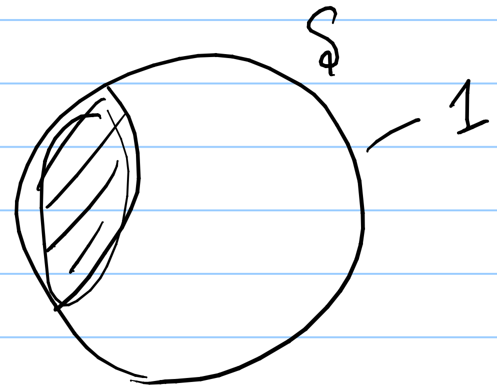


$$P(A|B)$$

$$= \frac{P(A \cap B)}{P(B)} = \frac{P(AB)}{P(B)}$$

$$P(D|L) = \frac{P(DL)}{P(L)}$$

$$= \frac{0.25}{0.6} = \frac{5}{12}$$



Example Two lines for wafers A, B

Chip a r

$P(A) = \frac{1}{3}$ $\quad P(B) = \frac{2}{3}$

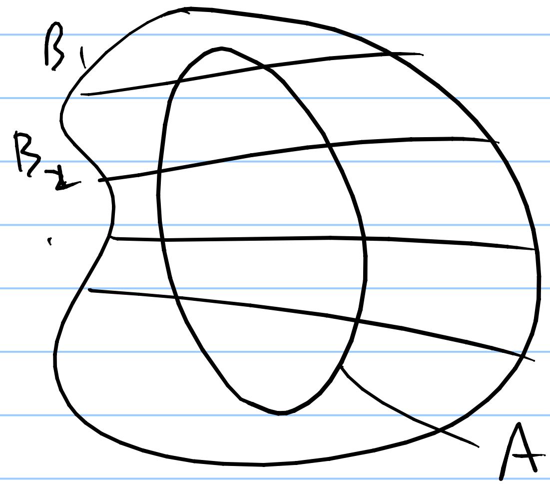
$\underline{P(a|A) = 0.9}$ $\quad \underline{P(a|B) = 0.8}$

$\underline{P(A|r)} > \underline{P(B|r)}$

Maximum
A posteriori
Decision

MAP

Total Prob law



$\underline{P(A)} = \sum P(AB_i)$ $\quad \{B_1, \dots, B_n\}$

$\left(P(A|B_i) = \frac{P(AB_i)}{P(B_i)} \right) \leftarrow$

$= \sum P(A|B_i) P(B_i)$

$$P(B_i|\underline{A}) = \frac{P(AB_i)}{P(A)} = \frac{P(A|B_i)\,P(B_i)}{\sum_j P(A|B_j)\,P(B_j)}$$

Bayes Rule