S12 - 0.0 - Tree/Table/Venn Theory Notes

Tree

$$P(A \cap B) = P(A) \times P(B|A) \;①$$

$$P(A \cap \bar{B}) = P(A) \times P(\bar{B}|A)$$
$$P(\bar{A} \cap B) = P(\bar{A}) \times P(B|\bar{A}) \;②$$

$$P(\bar{A} \cap \bar{B}) = P(B) \times P(B|B)$$
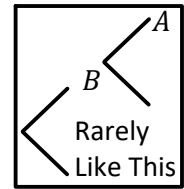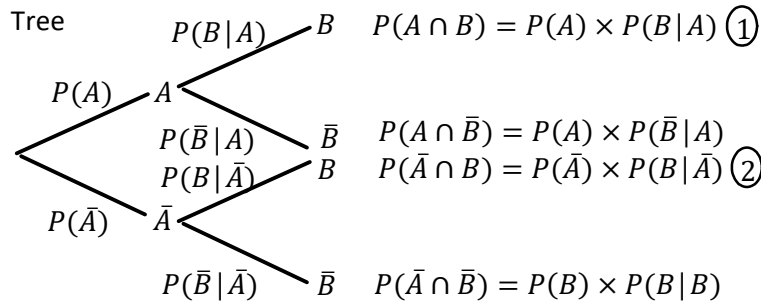
A happens
before B*

$$P(B \cap A) = P(A \cap B)$$
$$P(A) \times P(B|A) = P(A \cap B)$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)} \quad \text{Bayes Theorem}$$

The given is on the bottom
(And over the Given)

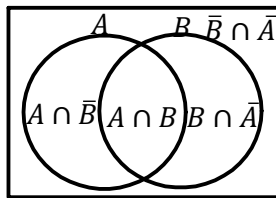$$P(A|B) = \frac{P(B \cap A)}{P(B)} \quad \text{Bayes Backwards}$$

$$P(A|B) = \frac{P(B|A) \times P(A)}{P(B|A) \times P(A) + P(B|\bar{A}) \times P(\bar{A})}$$
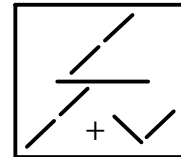
$$P(B) = ① + ②$$
$$P(B) = P(A) \times P(B|A) + P(\bar{A}) \times P(B|\bar{A})$$

$$P(A|B) = \frac{①}{① + ②}$$

$$U: A \cup B + \bar{B} \cap \bar{A}$$

Don't do a Venn for two
Mutually Exclusive Events

Table

	A	$\bar{A}$	$Total$
B	$A \cap B$	$\bar{A} \cap B$	B
$\bar{B}$	$A \cap \bar{B}$	$\bar{A} \cap \bar{B}$	$\bar{B}$
$Total$	A	$\bar{A}$	$\cup$

A Table is for Mutually
Exclusive Events

Probability Table

	A	$\bar{A}$	$Total$
B	$p(A \cap B)$	$p(\bar{A} \cap B)$	$p(B)$
$\bar{B}$	$p(A \cap \bar{B})$	$p(\bar{A} \cap \bar{B})$	$p(\bar{B})$
$Total$	$p(A)$	$p(\bar{A})$	1

Hearts ♥	Diamonds ♦	Spades ♠	Clubs ♣
Ace ♥	Ace ♦	Ace ♠	Ace ♣
2 ♥	2 ♦	2 ♠	2 ♣
3 ♥	3 ♦	3 ♠	3 ♣
4 ♥	4 ♦	4 ♠	4 ♣
5 ♥	5 ♦	5 ♠	5 ♣
6 ♥	6 ♦	6 ♠	6 ♣
7 ♥	7 ♦	7 ♠	7 ♣
8 ♥	8 ♦	8 ♠	8 ♣
9 ♥	9 ♦	9 ♠	9 ♣
10 ♥	10 ♦	10 ♠	10 ♣
Jack ♥	Jack ♦	Jack ♠	Jack ♣
Queen ♥	Queen ♦	Queen ♠	Queen ♣
King ♥	King ♦	King ♠	King ♣

SAMPLE SPACE

(4 Suits/13 Cards per Suit/52 Cards)

Sum of two dice

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Product of two dice

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36