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Conditioning & Bayes rule

$P(A|B)$

↳ Probablity of event A given B has occured

$$\boxed{P(A|B) = \frac{P(A\cap B)}{P(B)}}$$ {defined only when $P(B) > 0$}

This is a definition not a Theorem.

⇒ Conditional probabilities share properties of ordinary probabilities.

① $P(A|B) \geq 0$

② $P(\Omega|B) = 1$

③ $P(A\cup C|B) = P(A|B) + P(C|B)$

★ Multiplication rule

$$\boxed{P(A\cap B\cap C) = P(A)\cdot P(B|A)\cdot P(C|A\cap B)}$$

↳ This can be generalized to n terms.

★ Total probability theorem

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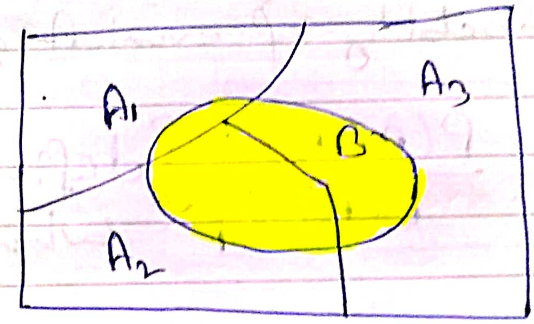
⇒* Let A_1, A_2, A_3 be partition of samplespace.



$$P(B) = P(B \cap A_1) + P(B \cap A_2) + P(B \cap A_3)$$

$$P(B) = P(A_1)P(B|A_1) + P(A_2)P(B|A_2) + P(A_3)P(B|A_3)$$

$$\boxed{P(B) = \sum P(A_i)P(B|A_i)}$$

* Bayes rule

$$\boxed{P(A_i|B) = \frac{P(A_i)P(B|A_i)}{\sum P(A_j)P(B|A_j)}}$$

→ {Systematic approach for incorporating new evidence}