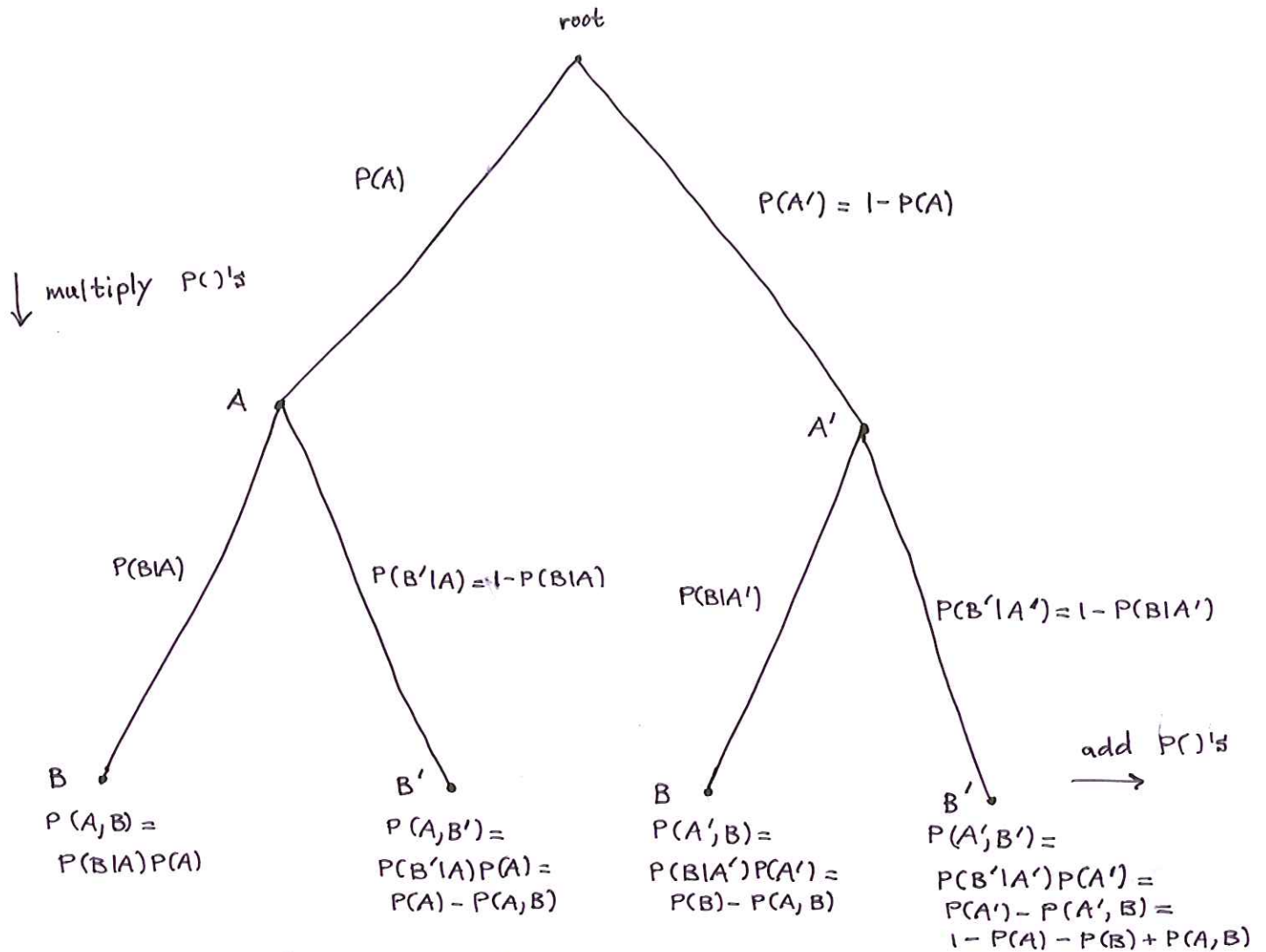




Leaves form a partition: mutually exclusive, and union = S

where $S \equiv$ sample space

By Law of Total probability:

$$P(A, B) + P(A, B') = P(A)$$

$$P(A, B) + P(A', B) = P(B)$$

$$P(A', B) + P(A', B') = P(A')$$

By Law of Additive Probability:

$$P(A \cup B) = P(A) + P(B) - P(A, B)$$

$$P(A \cup B | C) = P(A | C) + P(B | C) - P(A, B | C)$$

By definition of Conditional Probability

$$P(A|B) = P(A, B) / P(B) \quad \text{and} \quad P(B|A) = P(A, B) / P(A) \quad \text{and} \quad P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

$$A, B \text{ independent if and only if } P(A|B) = P(A) \Rightarrow P(A, B) = P(A)P(B)$$