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12.4 Bayes Theorem

- Suppose that F and X are events from the same sample space and $p(F) \neq 0$ and $P(X) \neq 0$. Then:

$$p(F|X) = \frac{p(X|F) \cdot p(F)}{p(X|F) \cdot p(F) + p(X|\bar{F}) \cdot p(\bar{F})} = \frac{p(X|F) \cdot p(F)}{p(X)}$$

12.5 Random Variables

- A random variable X is a function from the sample space S of an experiment to the real numbers. $X(S)$ denotes the range of the function X.

- The distribution of a random variable is the set of all pairs $[r, p(X=r)]$ such that $r \in X(S)$

12.6 Expectation of a Random Variable

- The expected value of a random variable X is denoted $E[X]$ and is defined as

$$E[X] = \sum_{s \in S} X(s) \cdot p(s)$$

where $p(s)$ is the probability of outcome s.

Alternative way

- If X is a random variable defined over an experiment with sample space S,

$$E[X] = \sum_{r \in X(S)} r \cdot p(X=r)$$

where $X(S)$ is the range of the function X.

12.7 Linearity of Expectations

- If X and Y are two random variables defined on the same sample space S, and c is a real number,

$$E[X+Y] = E[X] + E[Y]$$

$$E[cX] = cE[X]$$