P12 - 2.1 - Probability Intro

Number of Trials : Number of times experiment is repeated.

Outcomes : Different possible results. Event : A set of outcomes ie. Coin Toss

Sample Space "S": The set of all possible outcomes in an event. ie. Heads/Tails {H,T}

$P(E)$: Probability of event "E"

Frequency : Number of times a particular outcome observed.

Relative Frequency : Frequency divided by number of trials = Experimental Probability

$$Probability = \frac{number\ of\ desired\ outcomes}{total\ outcomes}$$

Probability of an Event must be between 0 and 1. $0 \le p(E) \le 1$

Flip a Coin

Probability of all outcomes adds to 1.

$let\ H = Heads$
$let\ T = Tails$

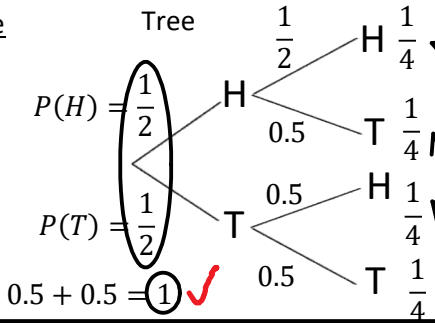
$P(H) = \frac{1}{2}$ $P(T) = \frac{1}{2}$ $P(H) + P(T) = \frac{1}{2} + \frac{1}{2} = 1$ $P(H \cup T) = 1$ $\cup : OR$

Flip a Coin Twice

$P(HH) = \frac{1}{4}$

$P(AB)$: Probability of A then B

Tree



Multiplication (Branches)

$P(HH) = P(H) \times P(H) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Addition (Leaves)

$P(H \cap T) = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ $\cap : AND$

Table

	H	T
H	HH	HT
T	TH	TT

$P(TT) = \frac{1}{4}$

Rolling a 6 sided Die Twice

Independent : Not dependant of previous outcomes

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

$P(6) = \frac{1}{6}$ $P(6|2) = \frac{1}{6}$ $given: |$ $P(A|B) = P(A)$

Standard Deck of Cards (without (w/o) replacement)

Dependent : Dependant of previous outcomes

$P(J) = \frac{4}{52}$ $P(J|A) = \frac{4}{51}$ $P(A|B) \neq P(A)$

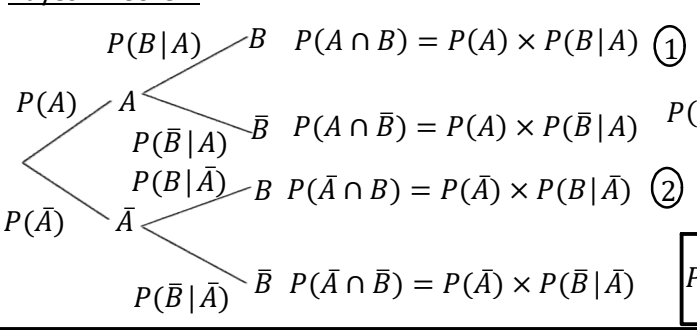
Compliment : Event will not happen ie. Not rolling a six (six sided die).

$P(\bar{E}) = 1 - P(E)$ $\bar{E}: Not\ E$

$P(\bar{6}) = 1 - P(6) = 1 - \frac{1}{6} = \frac{5}{6}$

Odds rolling 6: Odds in Favor : Odds Against 1:5

Bayes' Theorem



$P(B) = (1) + (2)$

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

$P(B \cap A) = P(A \cap B)$ Theory

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

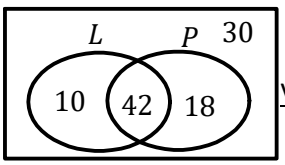
$P(A|B) = \frac{P(B \cap A)}{P(B)} = \frac{(1)}{(1)+(2)}$ Bayes'

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

Lie Detector Test

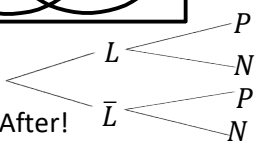
Says you Lied
Says you didn't Lie

	L : Lied	$\bar{L}$: Did not lie	Total
P : Positive	42	18	60
N : Negative	10	30	40
Total	52	48	100



Venn

Tree



Test is After!

$P(\bar{L}|P) = \frac{P(P \cap \bar{L})}{P(P)} = \frac{\frac{18}{100}}{\frac{60}{100}} = \frac{18}{60} = 0.3$

30% False Positive