3 Probability

Tuesday, September 1, 2020 11:00 AM

Probability - measure of uncertainty associated w/ events + their outcomes

Uncertainty = randomness

Random experiment
Examples:
- coin toss
- Roll a die

↳ repetition produces same or different outcomes
outcomes cannot be predicted w/ certainty

Simple Event
- Basic outcome of an experiment that cannot be decomposed into simpler outcomes

Simple - roll a 4
Event - roll an odd number (1,3,5)

Sample space - all possible outcomes of an experiment

Example:
Coin toss = $\{H, T\}$
Die roll = $\{1,2,3,4,5,6\}$

Toss 2 coins: $\{HH, HT, TT, TH\}$

Pick 2 marbles from a bag w/ Red and Black marbles
↳ $\{RR, RB, BB, BR\}$

Pick a card from a stack spelling "POLYTECHNIC"

Small, medium, Large cheese or pepperoni
↳ 6 combinations

Roll a die + toss a coin at the same time
↳ 12 outcomes

Union - either A or B
↳ $A \cup B$

Intersection - Both A and B
↳ $A \cap B$

Complement - Event does not occur
↳ A' or $\bar{A}$ or A^c

Properties of outcomes
- Exhaustive: all possible outcomes must be included
- mutually exclusive: No two outcomes can occur at the same time

Probability of given event A is written $P(A)$

$P(A) = n(A) \div n(S)$
↳ Total number of ALL outcomes in an event
↳ total number of outcomes in an event.

$0 \leq P(A) \leq 1$

Sum of all $P(*) = 1$

Law of large numbers: proportion of outcomes will converge to the probability

Disjoint outcomes: Cannot happen at the same time

Events are independent if the outcome of one does not affect another

a) $(.91 \cdot 1)^5 =$
b) $(.09 \cdot 1)^5 =$
c) $1 - (.91 \cdot 1)^5 =$

a) $.5 \cdot .91 = 45.5\%$
b) $(.5 \cdot .91)^2 = 20.7\%$
c) $.5 \cdot .91 = 4.5\%$

Conditional Probability: Probability of one event given that another event has occurred

$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$ = Probability of A given B

A = roll pair of 5s
B = Sum = 10, 11, or 12

$P(A) = (\frac{1}{6})^2 =$
$P(B) = (6/36)$
$P(A|B) =$
$P(B|A) =$

		Parents		
		Degree	no degree	total
teen	College	231	214	445
	no college	49	298	347
	Total	280	512	792

any parent has degree, chance teen has college?
231/280 = .825

random teen no college, chance parent has college?
49/347 =

teen attending college?
445/792 =

teen college, parents no college?
214/512 =

Sampling with replacement

Draws are independent

COUNTING RULES

#1) If any one of k mutually ex
k^n

#2) $(k_1)(k_2)(k_3)$ etc

#3) n items in order = $n!$

#4) Permutations $_nP_x = \frac{n!}{(n-x)!}$ x items from n items in order

#5) Combinations $_nC_x = n!/x!(n-x)!$ x items from n no order

.5% of pop has disease. 3% false positive. 2% false negative

Prob of positive result?
↳ 3% + .5% = 3.5%

Test positive, actually has it?
↳ $(.98)(.005) / (.98)(.005) + (.03)(.995) = .14 = 14\%$