Statistics

Lecture 13

Feb 19-8:47 AM

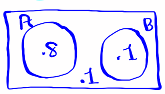
Some Review

Given $P(A) = .8$, $P(B) = .1$, find $P(A \text{ or } B)$ if

1) A and B are disjoint events. → $P(A \text{ and } B) = 0$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= .8 + .1 - 0 = \boxed{.9}$

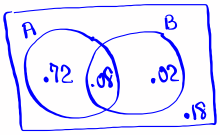


2) A and B are independent events. → $P(A \text{ and } B) = P(A) \cdot P(B)$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= .8 + .1 - (.8)(.1) = \boxed{.82}$

using Venn Diagram →



P(A only OR B only) $= \boxed{.74}$

$P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = \boxed{.18}$

$P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = \boxed{.92}$

→ DeMorgan's Law

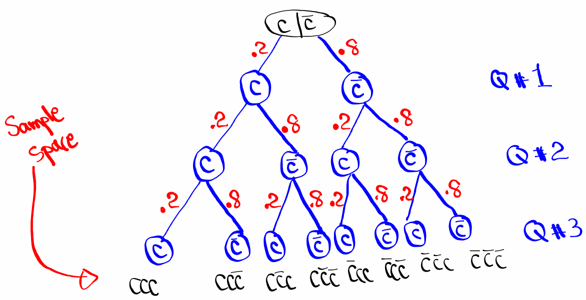
Nov 13-7:20 AM

You are guessing on a multiple-choice quiz with 3 questions.

Each question has 5 choices with only one correct choice

$C \to$ Correct $\quad P(C) = \frac{1}{5} = .2$

$\bar{C} \to$ Not Correct $\quad P(\bar{C}) = \frac{4}{5} = .8$



$P(3 \text{ Correct Ans}) = P(CCC) = (.2)(.2)(.2) = \boxed{.008}$ ✓

$P(2 \text{ Correct Ans}) = P(CC\bar{C}, C\bar{C}C, \bar{C}CC) = 3(.2)(.2)(.8) = \boxed{.096}$ ✓

$P(1 \text{ Correct Ans}) = P(C\bar{C}\bar{C}, \bar{C}C\bar{C}, \bar{C}\bar{C}C) = 3(.2)(.8)(.8) = \boxed{.384}$ ✓

$P(0 \text{ Correct Ans}) = P(\bar{C}\bar{C}\bar{C}) = (.8)(.8)(.8) = \boxed{.512}$ ✓

Nov 13-7:30 AM

# Correct	P(# Correct)
3	.008
2	.096
1	.384
0	.512

Clear all lists

Correct $\to$ L1

P(# Correct) $\to$ L2

Use L1 & L2 with $\boxed{\text{1-Var Stats}}$

Find

$\bar{x} = .6 \qquad S_x =$ Blank $\qquad n = 1$

Domain

$P(\text{at least one}) = 1 - P(\text{None})$

$P(\text{at least 1 Correct Ans}) = 1 - P(\text{No Correct Ans})$

$= 1 - P(\text{All incorrect})$

$= 1 - P(\bar{C}\bar{C}\bar{C})$

$= 1 - .512 = \boxed{.488}$

Nov 13-7:42 AM

Dependent Events

$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$

A happens, then B happens

Given

There are 10 balls, 4 Red, and 6 Blue balls.

Take 2 balls without Replacement.

$P(2 \text{ Reds}) = P(RR) = \frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90} = \boxed{\frac{2}{15}}$

$P(1R, 1B) = P(RB \text{ or } BR) = 2 \cdot \frac{4}{10} \cdot \frac{6}{9} = \frac{48}{90} = \boxed{\frac{8}{15}}$

$P(\text{No Red}) = P(BB) = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90} = \boxed{\frac{1}{3}}$

$\underbrace{RR \quad RB \quad BR \quad BB}_{\text{Sample Space}}$

# Red	P(# Red)
2	2/15
1	8/15
0	1/3

Red → L1

P(# Red) → L2

$\boxed{\text{1-Var Stats}}$ with L1 & L2

$\bar{x} = .8$ S_x = Blank $n = 1$

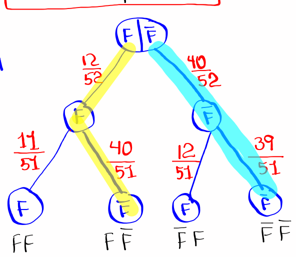
Nov 13-7:49 AM

A standard deck of playing Cards has 52 Cards and 12 are face Cards.

Take two Cards $\boxed{\text{without replacement.}}$

F → Face Card

$\bar{F}$ → Not Face Card



$P(2 \text{ face Cards}) = \frac{12}{52} \cdot \frac{11}{51} = \boxed{\frac{11}{221}}$

$P(1 \text{ face Card}) = P(F\bar{F} \text{ or } \bar{F}F) = 2 \cdot \frac{12}{52} \cdot \frac{40}{51} = \boxed{\frac{80}{221}}$

$P(\text{No face Cards}) = P(\bar{F}\bar{F}) = \frac{40}{52} \cdot \frac{39}{51} = \boxed{\frac{10}{17}}$

# face	P(# face)
2	11/221
1	80/221
0	10/17

face → L1

P(# face) → L2

Use $\boxed{\text{1-Var Stats}}$ with L1 & L2

$\bar{x} = .462$ S_x = Blank $n = 1$

P(at least 1 face Card) = 1 − P(No face Card)

$= 1 - P(\bar{F}\bar{F}) = 1 - \frac{10}{17} = \boxed{\frac{7}{17}}$

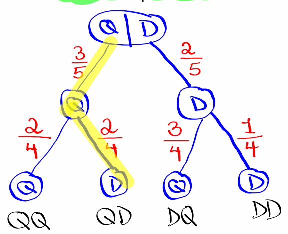
Nov 13-8:04 AM

3 Quarters and 2 Dimes

Take 2 Coins, No replacement

Q → Quarter

D → Dime



$P(50¢) = P(QQ) = \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{20} = \boxed{.3}$

$P(35¢) = P(QD \text{ or } DQ) = 2 \cdot \frac{3}{5} \cdot \frac{2}{4} = \frac{12}{20} = \boxed{.6}$

$P(20¢) = P(DD) = \frac{2}{5} \cdot \frac{1}{4} = \frac{2}{20} = \boxed{.1}$

Total ¢	P(Total ¢)
50¢	.3
35¢	.6
20¢	.1

Total ¢ → L1

P(Total ¢) → L2

1-Var Stats with L1 & L2

$\bar{x} = 38$ S_x = Blank $n = 1$

P(at least 1 Quarter) = 1 − P(No Quarter)

$= 1 - P(DD) = 1 - .1 = \boxed{.9}$

P(at least 1 Dime) = 1 − P(NO dime) = 1 − P(QQ)

$= 1 - .3 = \boxed{.7}$

Nov 13-8:21 AM

Conditional Probability

we Know

$P(A \text{ and } B) = P(A) \cdot P(B|A)$

If we Solve for P(B|A), we get

$$\boxed{P(B|A) = \frac{P(A \text{ and } B)}{P(A)}}$$

Suppose $P(A) = .8$, $P(B) = .5$, $P(A \text{ and } B) = .45$

$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.45}{.8} = \boxed{.563}$

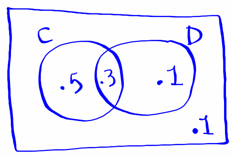
$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.45}{.5} = \boxed{.9}$

Nov 13-8:52 AM

$P(\text{Coffee}) = .8$

$P(\text{Donut}) = .4$

$P(\text{coffee and Donut}) = .3$



$$P(\text{Donut} \mid \text{Coffee}) = \frac{P(\text{Coffee and Donut})}{P(\text{Coffee})} = \frac{.3}{.8} = \boxed{.375}$$

$$P(\text{Coffee} \mid \text{Donut}) = \frac{P(\text{Coffee and Donut})}{P(\text{Donut})} = \frac{.3}{.4} = \boxed{.75}$$

Nov 13-8:58 AM

$P(\text{math}) = .6$

$P(\text{English}) = .8$

$P(\text{math} \mid \text{English}) = .75$

$$P(M \mid E) = \frac{P(M \text{ and } E)}{P(E)}$$

$$.75 = \frac{P(M \text{ and } E)}{.8}$$

Cross-Multiply

$P(\text{math and English}) = ?$

$$P(M \text{ and } E) = (.75)(.8)$$
$$= \boxed{.6}$$

$$P(\text{English} \mid \text{Math}) = \frac{P(M \text{ and } E)}{P(M)} = \frac{.6}{.6} = \boxed{1}$$

Sure Event

Nov 13-9:04 AM

P(Math) = .4

P(English) = .6

P(Math | English) = .5

P(Math and English) = ?

$P(M|E) = \frac{P(M \text{ and } E)}{P(E)}$

$.5 = \frac{P(M \text{ and } E)}{.6}$

$P(M \text{ and } E) = (.5)(.6) = \boxed{.3}$

$P(\text{English} | \text{Math}) = \frac{P(M \text{ and } E)}{P(M)} = \frac{.3}{.4} = \boxed{.75}$

Nov 13-9:12 AM

Intro. to Counting:

If You flip a Coin → Two choices H or T

If You flip a Coin twice →

First flip · Second flip

2 · 2 = 4 Total choices

HH HT TH TT

$\underbrace{\text{HH HT TH TT}}_{\text{4 choices}}$

$\overbrace{0,1,2,3,4,5,6,7,8,9}^{\text{10 choices}}$

Select 4 digits from 0 to 9 for passcode

1) with repetition 10 · 10 · 10 · 10

10,000 choices

2) No repetition 10 · 9 · 8 · 7

5040 choices

How many ways can You Select a letter followed by 4 digits when letters are Case Sensitive, and repetition allowed for digits?

52 10 10 10 10

$\boxed{52,000}$ choices

P(I guess Your Passcode) = $\frac{1}{52000}$

Nov 13-9:20 AM

There are 5 people, and we need to select two.

Adam
Bill
Carol
David
Emily

~~AB~~	~~AC~~	~~AD~~	~~AE~~
BA	~~BC~~	~~BD~~	~~BE~~
CA	CB	~~CD~~	~~CE~~
DA	DB	DC	~~DE~~
EA	EB	EC	ED

$5 \cdot 4 = 20$

If order does not matter

10 choices

choose

$_nC_r$

object choose r

Order does not matter

$$_nC_r = \frac{n!}{r!\,(n-r)!}$$

$$_5C_2 = \frac{5!}{2!\cdot(5-2)!} = \frac{5\cdot4\cdot3\cdot2\cdot1}{2\cdot1\cdot3\cdot2\cdot1} = \boxed{10}$$

5 $\boxed{\text{MATH}}$ $\boxed{\rightarrow}$ PRB $\boxed{\downarrow}$ $\boxed{_nC_r}$ 2 $\boxed{\text{Enter}}$

Nov 13-9:28 AM

12 basketball players.

We need 5 to start the game.

Order does not matter, All players can play any position.

How many ways can this be done?

$$_{12}C_5 = \boxed{792}$$

Nov 13-9:37 AM

CA Lotto

50 Numbers, choose 5 numbers in any order.

\# of ways → $_{50}C_5 = 2,118,760$

$P(\text{all 5 winning \#s}) = \dfrac{1}{2,118,760}$

Nov 13-9:40 AM

3 Females & 7 Males.

Select 3 people, order does not matter.

F F F

Some F & Some M

M M M

$P(\text{3 Females}) = \dfrac{_3C_3 \cdot {_7C_0}}{_{10}C_3} = \boxed{\dfrac{1}{120}}$

$P(\text{3 Males}) = \dfrac{_3C_0 \cdot {_7C_3}}{_{10}C_3} = \dfrac{35}{120} = \boxed{\dfrac{7}{24}}$

$P(\text{at least 1 Female}) = 1 - P(\text{No Females}) = 1 - P(\text{All males})$
$= 1 - \dfrac{7}{24} = \boxed{\dfrac{17}{24}}$

F F F

Some F & Some M

M M M

$P(\text{at least 1 male}) = 1 - P(\text{No males})$
$= 1 - P(\text{All Females}) = 1 - \dfrac{1}{120} = \boxed{\dfrac{119}{120}}$

Nov 13-9:43 AM