Statistics
Spring 2023
Lecture 19

Feb 19-8:47 AM

Suppose $P(A) = .85$, $P(B) = .1$, and $P(A \text{ and } B) = .05$

1) $P(\bar{A}) = 1 - P(A) = \boxed{.15}$

2) $P(\bar{B}) = 1 - P(B) = \boxed{.9}$

3) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= \boxed{.9}$

$P(A \text{ only}) = P(A) - P(A \text{ and } B) = .8$
$P(B \text{ only}) = P(B) - P(A \text{ and } B) = .05$

4) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - .9 = \boxed{.1}$
De Morgan's Law

5) $P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - .05 = \boxed{.95}$

6) find odds in favor of event B.
$P(B) : P(\bar{B})$
$.1 : .9$ → $\boxed{1 : 9}$

7) find odds against event A.
$P(\bar{A}) : P(A)$
$.15 : .85$ → $\boxed{3 : 17}$

4) Construct Venn Diagram

A   B
.8 (.05) .05
.1
Total = 1

Mar 9-7:15 AM

Suppose the odds in favor of event A are 1:39.

1) find odds against event A.

$$\boxed{39 : 1}$$

2) find P(A) in decimal.

$$P(A) = \frac{1}{1+39} = \frac{1}{40} = \boxed{.025}$$

3) find P($\overline{A}$) in reduced fraction.

$$P(\overline{A}) = 1 - P(A)$$
$$= 1 - \frac{1}{40} = \boxed{\frac{39}{40}}$$

Mar 9-7:27 AM

Multiplication Rule: SG 12

Keyword: AND

Multiple-Action Event

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

A happens first,
then B happens   Given

Consider flipping a fair coin Twice.

$$P(\text{Tails}) = .5$$
$$P(\text{Heads}) = .5$$

TT   TH   HT   HH

Sample Space

$$P(\text{two tails}) = P(TT) = P(T) \cdot P(T)$$
$$= (.5)(.5) = \boxed{.25}$$

Mar 9-7:32 AM

You are taking a quiz with 3 True/false questions. You are making random guesses.

$P(T) = \frac{1}{2}$,

$P(F) = \frac{1}{2}$ P(all T) =

T	T	T
T	T	F
T	F	T
T	F	F
F	T	T
F	T	F
F	F	T
F	F	F

Sample Space

$P(TTT) = P(T) \cdot P(T) \cdot P(T)$

$= \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{8}}$

Mar 9-7:38 AM

A standard deck of playing cards has 52 cards, 26 Red, 12 face, 4 Aces.

If you randomly draw one Card,

$P(Red) = \frac{26}{52} = \boxed{\frac{1}{2}}$ $P(face) = \frac{12}{52} = \boxed{\frac{3}{13}}$ $P(Ace) = \frac{4}{52} = \boxed{\frac{1}{13}}$

Now let's draw 2 Cards, with replacement

$P(RR) = P(R) \cdot P(R) = \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{4}}$

$P(FF) = P(F) \cdot P(F) = \frac{3}{13} \cdot \frac{3}{13} = \boxed{\frac{9}{169}}$

what if we draw 3 cards with replacement.

$P(3 \text{ Aces}) = P(AAA) = P(A) \cdot P(A) \cdot P(A)$

$= \frac{1}{13} \cdot \frac{1}{13} \cdot \frac{1}{13} = \boxed{\frac{1}{2197}}$

Mar 9-7:42 AM

Exam 1 is next Thursday.   3

You are taking a multiple-choice quiz with ⟨3 questions⟩ You are making random guesses. Each question has 5 choices but only one choice is correct.

1) Who is the President of USA now?

a) Bush   b) Trump   ⟨c) Biden⟩   d) Obama

e) None of above

$P(\text{Correct}) = \dfrac{1}{5}$

$P(\overline{\text{Correct}}) = \dfrac{4}{5}$

C C C

Some C & Some $\overline{C}$

$\overline{C}\ \overline{C}\ \overline{C}$

$P(CCC) = \dfrac{1}{5} \cdot \dfrac{1}{5} \cdot \dfrac{1}{5} = \boxed{\dfrac{1}{125}}$

$P(\overline{C}\,\overline{C}\,\overline{C}) = \dfrac{4}{5} \cdot \dfrac{4}{5} \cdot \dfrac{4}{5} = \boxed{\dfrac{64}{125}}$

Mar 9-7:52 AM

Suppose you flip a loaded coin twice.

T T
T H   } Sample Space
H T
H H

$P(T) = .3$

$P(H) = .7$

$P(TT) = (.3)(.3) = \boxed{.09}$

$P(HH) = (.7)(.7) = \boxed{.49}$

Tree Diagram

First Flip

Second Flip

← Sample Space

TT   TH   HT   HH

$P(TT) = (.3)(.3) = \boxed{.09}$

$P(TH) = (.3)(.7) = \boxed{.21}$ } Total Prob. = 1

$P(HT) = (.7)(.3) = \boxed{.21}$

$P(HH) = (.7)(.7) = \boxed{.49}$

Mar 9-8:01 AM
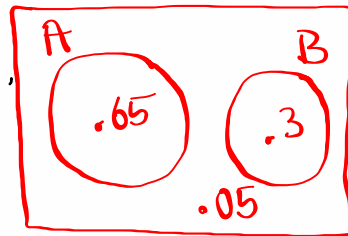
Class QZ 4:

$P(A) = .65$, $P(B) = .3$ A & B are M.E.E.

1) $P(\bar{A}) = 1 - P(A) = \boxed{.35}$

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

   $= .65 + .3 - 0 = \boxed{.95}$

3) Construct Venn Diagram,

Mar 9-8:16 AM