# Statistics

# Lecture 12

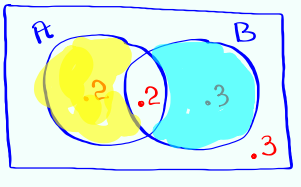
Feb 19-8:47 AM

Class QZ 4

Given $P(A)=.4$, $P(B)=.5$, A & B are independent events

1) Find $P(A \text{ and } B) = P(A) \cdot P(B)$
$= (.4)(.5) = \boxed{.2}$

2) Find $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .4 + .5 - .2 = \boxed{.7}$




$P(A \text{ only}) = .2$

$P(B \text{ only}) = .3$

$P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .7 = \boxed{.3}$

De Morgan's Law

$P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .2$
$= \boxed{.8}$

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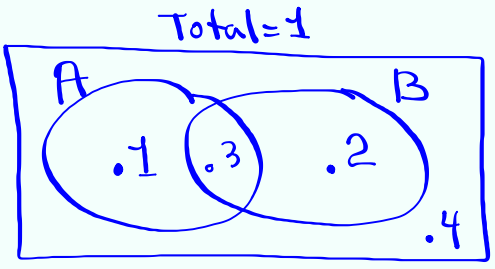
Suppose $P(A) = .4$, $P(B) = .5$, $P(A \text{ and } B) = .3$

1) $P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.3}{.4} = \frac{3}{4} = .75$

Given

2) $P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.3}{.5} = \frac{3}{5} = .6$

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A box has 4 Red & 6 Blue balls.

Randomly we take 2 balls without replacement

Sample Space Collection of all possible outcomes

RR RB BR BB

$P(RR) = \frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90}$

$P(RB) = \frac{4}{10} \cdot \frac{6}{9} = \frac{24}{90}$

$P(BR) = \frac{6}{10} \cdot \frac{4}{9} = \frac{24}{90}$

$P(BB) = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90}$

| #R | P(#R) |
|---|---|
| 2 | 12/90 |
| 1 | 48/90 |
| 0 | 30/90 |

STAT → CALC

1:1-Var Stats

List: L1

FreqList: L2

Calculate

#R → L1

P(#R) → L2

| L1 | L2 |
|---|---|
| 2 | 12/90 |
| 1 | 48/90 |
| 0 | 30/90 |

$\bar{x} = .8$

$S = S_x$ Blank

$n = 1$ ← Total Prob.

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P(at least 1 Red ball) = 1 − P(No red Ball)

= 1 − P(BB)

$= 1 - \frac{30}{90} = 1 - \frac{1}{3} = \boxed{\frac{2}{3}}$

P(at least 1 Blue ball) = 1 − P(No blue ball)

= 1 − P(RR)

$= 1 - \frac{12}{90} = 1 - \frac{2}{15} = \boxed{\frac{13}{15}}$

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A piggy bank has 5 dimes and 10 nickels.

Take 2 Coins with replacement

Sample Space NN ND DN DD

$P(NN) = P(10¢) = \frac{10}{15} \cdot \frac{10}{15} = \frac{100}{225}$

$P(ND) = P(15¢) = \frac{10}{15} \cdot \frac{5}{15} = \frac{50}{225}$

$P(DN) = P(15¢) = \frac{5}{15} \cdot \frac{10}{15} = \frac{50}{225}$

$P(DD) = P(20¢) = \frac{5}{15} \cdot \frac{5}{15} = \frac{25}{225}$

| ¢ Total | P(¢ Total) |
|---|---|
| 10 | 100/225 |
| 15 | 100/225 |
| 20 | 25/225 |

Total ¢ → L1

P(Total ¢) → L2

use 1-Var Stats with L1 & L2

$\bar{x} = 13.\overline{3}$

$S_x$ = Blank

$n = 1$

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P(at least 1 dime) = 1 − P(No dimes)

= 1 − P(NN)

$= 1 - \frac{100}{225} = \frac{125}{225} = \boxed{\frac{5}{9}}$

P(at least 1 nickel) = 1 − P(No nickels)

= 1 − P(DD)

$= 1 - \frac{25}{225} = \frac{200}{225} = \boxed{\frac{8}{9}}$

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You are taking a quiz with 4 questions.

Each question has 3 choices, but one correct choice.

You are making random guesses.

C → Correct , $\bar{C}$ → Incorrect

C C C C

Some C

Some $\bar{C}$

$\bar{C}$ $\bar{C}$ $\bar{C}$ $\bar{C}$

P(All Correct) $= \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{81}$

P(All incorrect) $= \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} = \frac{16}{81}$

P(at least 1 correct answer)

= 1 − P(No Correct)

$= 1 - P(\text{All incorrect}) = 1 - \frac{16}{81} = \frac{65}{81}$

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A deck of playing cards has 40 cards, 8 faces, and 3 aces.

If we randomly select one card,

1) P(draw face) $= \frac{8}{40} = \boxed{\frac{1}{5}}$

2) P(draw Ace) $= \boxed{\frac{3}{40}}$

Find odds in favor of selecting a face card.

# face : # face

8 : 32 → $\boxed{1:4}$

Find odds against selecting a face card.

$\boxed{4:1}$

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Suppose $P(E) = .32$

$.32 \div .68$

Math | 1: Frac

Enter

$\frac{8}{17}$

1) $P(\bar{E}) = 1 - P(E) = 1 - .32 = \boxed{.68}$

2) odds in favor of event $E$

$P(E) : P(\bar{E})$

$.32 : .68$ → $\boxed{8:17}$

3) odds against event $E$. $\boxed{17:8}$

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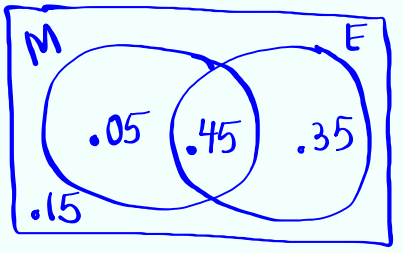
$P(\text{Math}) = .5$

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

$P(\text{Math and English}) = .45$




1) Make Venn Diagram.

2) $P(\text{Math} \mid \text{English}) = \dfrac{P(M \text{ and } E)}{P(E)} = \dfrac{.45}{.8}$

$= \dfrac{9}{16} = .5625$

$= .563$

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5 Females, 10 males, Select 3 people

No replacement, order does not matter

$P(3 \text{ Females}) = \dfrac{5}{15} \cdot \dfrac{4}{14} \cdot \dfrac{3}{13} = \boxed{\dfrac{2}{91}}$

$= \dfrac{{}_5C_3 \cdot {}_{10}C_0}{{}_{15}C_3} = \dfrac{10}{455} = \dfrac{2}{91}$

$P(2F \text{ \& } 1M) = \dfrac{{}_5C_2 \cdot {}_{10}C_1}{{}_{15}C_3} = \dfrac{100}{455} = \dfrac{20}{91}$

FFM
FMF
MFF

$P(1F \text{ \& } 2M) = \dfrac{{}_5C_1 \cdot {}_{10}C_2}{{}_{15}C_3} = \dfrac{225}{455} = \dfrac{45}{91}$

FMM
MFM
MMF

$P(3 \text{ Males}) = \dfrac{{}_5C_0 \cdot {}_{10}C_3}{{}_{15}C_3} = \dfrac{120}{455} = \dfrac{24}{91}$

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

= 1 − P(All males)

= 1 − 24/91 = 67/91

P(at least 1 male) = 1 − P(No male)

= 1 − P(All Females)

= 1 − 2/91 = 89/91

| # Females | P(# Females) |
|---|---|
| 3 | 2/91 |
| 2 | 20/91 |
| 1 | 45/91 |
| 0 | 24/91 |

# Females → L1

P(# Females) → L2

use 1-Var stats with L1 & L2

$\bar{x} = 1$

$S_x$ = Blank

$n = 1$

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Complete the chart below

| x | P(x) | xP(x) | $x^2P(x)$ |
|---|---|---|---|
| 1 | .2 | .2 | .2 |
| 2 | .5 | 1.0 | 2.0 |
| 3 | .3 | .9 | 2.7 |

1) $\sum P(x) = 1$

2) $\sum xp(x) = 2.1$

3) $\sum x^2p(x) = 4.9$

4) Compute $\sum x^2p(x) - \left(\sum xp(x)\right)^2$

$= 4.9 - 2.1^2 = \boxed{.49}$

5) $\sqrt{\text{Last Answer}} = \sqrt{.49} = \boxed{.7}$

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| $x$ | $P(x)$ | $xP(x)$ | $x^2P(x)$ |
|---|---|---|---|
| 1 | .1 | .1 | .1 |
| 2 | .2 | .4 | .8 |
| 3 | .4 | 1.2 | 3.6 |
| 4 | .3 | 1.2 | 4.8 |
| L1 | L2 | | |

1) $\sum P(x) = 1$

2) $\sum xP(x) = 2.9$ ✓

3) $\sum x^2P(x) = 9.3$

4) Compute $\sum x^2P(x) - \left(\sum xP(x)\right)^2$

$= 9.3 - (2.9)^2 = \boxed{.89}$ ✓

5) $\sqrt{\text{Last Answer}} = \sqrt{.89} \approx \boxed{.943}$ ✓

$x \rightarrow$ L1 Use 1-Var Stats $\bar{x} = 2.9$

$P(x) \rightarrow$ L2 with L1 & L2 $S_x$ = Blank

VARS 5: Statistics 4: $\sigma_{\bar{x}}$ $n = 1$

$x^2$ Enter .89

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