Statistics

Lecture 6

Feb 19-8:47 AM

Intro. to Probabilities

SG 10

E → Desired event (outcome)

P(E) → Prob. that E happens

$$P(E) = \frac{\text{Total \# of all desired outcomes}}{\text{Total \# of all outcomes}}$$

Acceptable answers:
1. Reduced fraction
2. Round to 3-dec. Places
3. Scientific Notation

10 Females, 15 males, Randomly Select one Person

$$P(\text{Select a female}) = \frac{10 \text{ Females}}{25 \text{ people}} = \boxed{\frac{2}{5}} = \boxed{.4}$$

Oct 6-5:07 PM

Standard deck of playing Cards

52 Cards, 26 Red, 12 Face, 4 aces.

Randomly draw one Card,

$\boxed{\text{Math}}\ \boxed{2{:}\blacktriangleright\text{Dec}}\ \boxed{\text{Enter}}$

$P(\text{Red}) = \frac{26}{52} = \boxed{.5}$

$P(\text{Face}) = \frac{12}{52} = \boxed{\frac{3}{13}} \approx \boxed{.231}$

$12\ \boxed{\div}\ 52\ \boxed{\text{Math}}\ \boxed{1{:}\blacktriangleright\text{Frac}}\ \boxed{\text{enter}}$

$P(\text{face or ace})$

$= \frac{12+4}{52} = \frac{16}{52} = \boxed{\frac{4}{13}} = \boxed{.308}$

$P(\text{face and ace})$

$= \frac{0}{52} = \boxed{0}$

Do not place a line in Your Zeros.

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$E \to$ Desired event

$\overline{E} \to$ E-bar, not E, E-Complement

$$P(E) + P(\overline{E}) = 1$$

$$\boxed{P(\overline{E}) = 1 - P(E)}$$

Complement Rule

$P(\text{Rains}) = .15$

$P(\overline{\text{Rain}}) = 1 - P(\text{Rain}) = 1 - .15 = \boxed{.85}$

if You draw one Card from a Standard deck of playing Cards,

$P(\text{Ace}) = \frac{4}{52} = \frac{1}{13}$

$P(\overline{\text{ACE}}) = \frac{48}{52} = \frac{12}{13}$

$\to P(\text{Ace}) + P(\overline{\text{Ace}}) =$

$\frac{1}{13} + \frac{12}{13} =$

$\frac{13}{13} = 1$ ✓

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If we randomly one person on the street,

P(he/she has a birthday today) $= \boxed{\frac{1}{365}}$

P(he/she has a birthday this Calendar Month) $= \boxed{\frac{1}{12}}$

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Some rules and terminologies

1) $0 \le P(E) \le 1$

2) Sum of all probabilities is always 1.

3) $P(E) = 1 \iff$ Sure event

4) $P(E) = 0 \iff$ Impossible event

5) $0 < P(E) \le .05 \iff$ Rare event

6) $P(\bar{E}) = 1 - P(E) \iff$ Complement Rule

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Suppose $P(A) = .025$

1) write $P(A)$ in % notation

$P(A) = .025(100)\% = \boxed{2.5\%}$

2) write $P(A)$ in reduced fraction

.025 [Math] [1:▶Frac] [Enter] $\boxed{\frac{1}{40}}$

3) Find $P(\bar{A})$ in decimal

$P(\bar{A}) = 1 - P(A) = 1 - .025 = \boxed{.975}$

4) Find $\frac{P(A)}{P(\bar{A})}$ in reduced fraction.

$\frac{.025}{.975} = \boxed{\frac{1}{39}}$

.025 [÷] .975 [Math] [1:▶Frac] [Enter]

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Do You Support Prop 50? Yes or No

	Yes	No	Total
Republican	$\boxed{4}$	36	40
Democrat	50	10	60
Total	54	46	100

If we randomly Select one of them

$P(\text{Democrat}) = \frac{60}{100} = \boxed{.6}$

$P(\text{Democrat or No}) = \frac{96}{100} = \boxed{.96} = \boxed{\frac{24}{25}}$

$\underbrace{P(\text{Republican } \boxed{\text{and}} \text{ Yes})}_{\text{Rare event}} = \frac{4}{100} = \boxed{.04} \leq .05$

$\underbrace{P(\text{Yes and No})}_{\text{Impossible event}} = \frac{0}{100} = \boxed{0}$

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SG 11

Addition Rule

Keyword OR

Single Action Event

$$\boxed{P(A \text{ or } B) = P(A) + P(B) - P(\underbrace{A \text{ and } B}_{\text{Both}})}$$

ex: $P(A) = .7$, $P(B) = .5$, $P(A \text{ and } B) = .4$

1) $P(\overline{A}) = 1 - P(A) = 1 - .7 = \boxed{.3}$

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

$\uparrow$ Addition Rule

$= .7 + .5 - .4 = \boxed{.8}$

3) $P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .4 = \boxed{.6}$

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

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

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

$P(\overbrace{\text{Coffee and Donut}}^{\text{over lap}}) = .25$

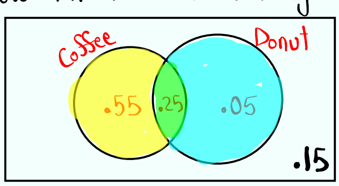
1) $P(\overline{\text{Coffee}}) = 1 - P(C) = 1 - .8 = \boxed{.2}$

2) $P(\text{Coffee or Donut}) = P(C) + P(D) - P(C \text{ and } D)$

$= .8 + .3 - .25 = \boxed{.85}$

Let's show this in a Venn Diagram

$.8 - .25$
$= .55$



$.3 - .25$
$= .05$

Total = 1 ✓

$P(\text{Coffee only OR Donut only}) = .55 + .05$

$= \boxed{.6}$

Oct 6-6:00 PM

when events A & B do not overlap, they are Called Mutually Exclusive Events

Disjointed Events

$\boxed{P(A \text{ and } B) = 0}$

ex: $P(A) = .6 \quad P(B) = .3$, A & B are M.E.E.

1) $P(\bar{A}) = 1 - .6 = \boxed{.4}$

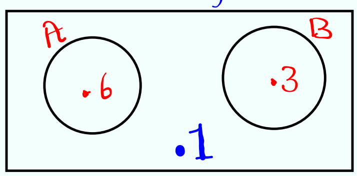
2) $P(\bar{B}) = 1 - .3 = \boxed{.7}$

3) $P(A \text{ and } B) = \boxed{0}$

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

$= .6 + .3 - 0 = \boxed{.9}$

5) Construct Venn Diagram.



Total = 1 ✓

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De Morgan's Law:

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

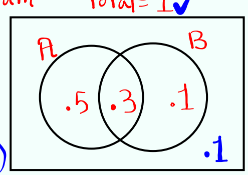
$P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B})$

$P(A) = .8 \quad , \quad P(B) = .4 \quad , \quad P(A \text{ and } B) = .3$

1) Construct Venn Diagram Total = 1 ✓

$.8 - .3 = .5$

$.4 - .3 = .1$



2) $P(A \text{ or } B)$

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

$= .8 + .4 - .3 = \boxed{.9}$

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

De Morgan's Law

$= 1 - .9$

$= \boxed{.1}$

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

$= \boxed{.7}$

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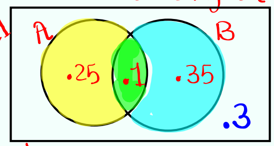
P(A only) = .25

P(B only) = .35

P(A and B) = .1

Construct Venn Diagram

Total = 1



$P(A) = .25 + .1 = \boxed{.35}$ $P(B) = .35 + .1 = \boxed{.45}$

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

$= .35 + .45 - .1 = \boxed{.7}$

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

De Morgan's Law

$P(\overline{A} \text{ or } \overline{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .1 = \boxed{.9}$

$P(A\text{only or } B\text{only}) = .25 + .35 = \boxed{.6}$

NO overlap

$P(\underbrace{A\text{only and } B\text{only}}_{\text{M.E.E.}}) = \boxed{0}$

SG 11 ✓

Oct 6-6:30 PM

Intro. to odds:

Odds in favor of event E are

a : b

times E happens

time $\overline{E}$ happens

I flipped a coin 20 times. it landed tails 12 times.

odds in favor of landing tails are

$\# \text{ tails} : \# \overline{\text{tails}}$

12 : 8

Simplify → $\boxed{3:2}$

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What are the odds in favor of drawing an ace from a full deck of playing cards?

$\# \text{ Aces} : \# \overline{\text{Aces}}$

$4 : 48$

Divide by 4 $\boxed{1:12}$

If odds in favor of event E are

$a : b,$

odds against event E are

$b : a$

odds in favor of drawing a face card

$12 : 40 \rightarrow 3 : 10$

odds against drawing face $\boxed{10:3}$

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How to find $P(E)$ & $P(\overline{E})$ when odds in favor of E are $a : b$

$\boxed{P(E) = \frac{a}{a+b}}$ $\boxed{P(\overline{E}) = \frac{b}{a+b}}$

Suppose odds in favor of event E are $1 : 39$

1) Find odds against E. $\boxed{39 : 1}$

2) Find $P(E) = \frac{1}{1+39} = \boxed{\frac{1}{40}}$

3) Find $P(\overline{E}) = \frac{39}{1+39} = \frac{39}{40}$

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How to find odds in favor of E when P(E) is given:

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

Always Simplify

Suppose $P(E) = .125$

1) $P(\bar{E}) = 1 - .125 = \boxed{.875}$

2) odds in favor of event E.

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

$.125 : .875 \Rightarrow 1 : 7$

.125 [÷] .875 [Math] [1:▶Frac] [Enter] $\frac{1}{7}$

3) odds against E $\boxed{7:1}$

SG (Almost first 3 pages)

Oct 6-7:01 PM