Statistics

Lecture 6

Feb 19-8:47 AM

SG 10 - 13

Intro. to Probabilities

$E \rightarrow$ desired event (outcome)

$P(E) \rightarrow$ Prob. that E happens.

Acceptable answers:

1) Rounded to 3-decimal places

2) Reduced fraction

3) Scientific notation

4) Percent Notation

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

Apr 5-8:02 AM

A box has 12 red and 8 blue balls.

Randomly take one ball,

$P(\text{Red Color}) = \frac{12}{20} = \frac{3}{5}$

12 ÷ 20 MATH 1: Enter

$= .6$ MATH 2: Enter

$P(\text{Blue Color}) = \frac{8}{20} = \frac{2}{5} = .4$

Select one Card from a standard deck of playing cards. 52 Cards, 26 Red, 12 face, 4 aces

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

$P(\text{ace}) = \frac{4}{52} = \frac{1}{13}$ $P(\text{face or ace}) = \frac{16}{52} = \frac{4}{13}$ (12, 4)

$P(\text{face and ace}) = \frac{0}{52} = 0$ Do not use 0 or zero.

Apr 5-8:07 AM

I surveyed 80 people, I asked them if they are Smokers or not.

	Yes	NO	Total
Males	8	22 ✓	30
Females	20 ✓	30 ✓	50
Total	28	52	80

If we randomly Select one of them,

$P(\text{Male}) = \frac{30}{80} = \frac{3}{8}$

$P(\text{Female}) = \frac{50}{80} = \frac{5}{8}$

$P(\text{Yes}) = \frac{28}{80} = \frac{7}{20}$

$P(\text{Yes and Male}) = \frac{8}{80} = \frac{1}{10}$

$P(\text{NO or Female}) = \frac{72}{80} = \frac{9}{10}$

Apr 5-8:17 AM

Choose a number from 1 to 40.

1, 2, 3, 4, 5, 6, . . . , 34, 35, 36, 37, 38, 39, 40

P(Selection is below 4) = $\frac{3}{40}$

P(Selection is at least 35) = $\frac{6}{40} = \frac{3}{20}$

P(Selection is below 4 and at least 35)

$= \frac{0}{40} = 0$

Do not use ∅ for Zero.

Apr 5-8:26 AM

$E \rightarrow$ Desired event

$\bar{E} \rightarrow$ E-bar, E-Complement, not E

$P(E) + P(\bar{E}) = 1$ Complement Rule

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

P(Rain) = .4

P(Rain) = 1 − P(Rain) = 1 − .4 = .6

$P(E) = \frac{2}{15}$

$P(\bar{E}) = 1 - P(E) = 1 - \frac{2}{15} = \frac{13}{15}$

1 [−] 2 [÷] 15 MATH 1:▶Frac Enter

P(E) = 7.5%.

1) P(E) in decimal. P(E) = 7.5% = 7.5(.01) = .075

2) P(E) in reduced fraction. .075 MATH 1:▶Frac Enter P(E) = $\frac{3}{40}$

3) $P(\bar{E})$ in Percent notation.

$P(\bar{E}) = 1 - P(E) = 1 - 7.5\% = 100\% - 7.5\% = 92.5\%$

Apr 5-8:31 AM

Some Prob. Rules:

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

2) Sum of all prob. 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

5% $\Rightarrow$ 95% usual Range
5% $\rightarrow$ unusual

6) $P(E) + P(\bar{E}) = 1$

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

SG 10 ✓

Apr 5-8:41 AM

Addition Rule

Keyword : OR

Single action event

Both
↓
overlap

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

ex: $P(A) = .4$, $P(B) = .7$, $P(A \text{ and } B) = .25$

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

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

3) $P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .25 = \boxed{.75}$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .4 + .7 - .25 = \boxed{.85}$

5) $P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .85 = \boxed{.15}$

Apr 5-8:47 AM

$P(HB) = .6$

$P(FF) = .5$

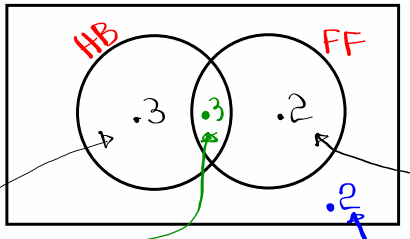
$P(HB \text{ and } FF) = .3$

1) $P(\overline{HB}) = 1 - P(HB)$
$= 1 - .6 = \boxed{.4}$

2) $P(\overline{FF}) = 1 - P(FF)$
$= 1 - .5 = \boxed{.5}$

3) $P(HB \text{ or } FF) = P(HB) + P(FF) - P(HB \text{ and } FF)$
$= .6 + .5 - .3 = \boxed{.8}$

Now using Venn Diagram.



$P(HB \text{ only}) = .6 - .3 = \boxed{.3}$

$P(FF \text{ only}) = .5 - .3 = \boxed{.2}$

Apr 5-8:56 AM

Given $P(A) = .75$, $P(B) = .15$

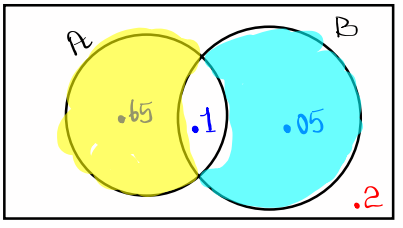
$P(A \text{ and } B) = .1$

1) $P(\overline{A}) = 1 - P(A)$
$= 1 - .75 = \boxed{.25}$

2) $P(\overline{B}) = 1 - P(B)$
$= 1 - .15$
$= \boxed{.85}$

3) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .75 + .15 - .1 = \boxed{.8}$

4) Construct Venn Diagram



$P(A \text{ only}) = .75 - .1 = .65$

$P(B \text{ only}) = .15 - .1 = .05$

Total = 1

5) $P(A \text{ only} \text{ OR } B \text{ only}) = .65 + .05 = \boxed{.7}$

Apr 5-9:07 AM

Events A and B are Mutually Exclusive Events or Disjoint Events if they can not happen together. $\Rightarrow P(A \text{ and } B) = 0$.

Ex: $P(A) = .65$, $P(B) = .25$, A & B are M.E.E.

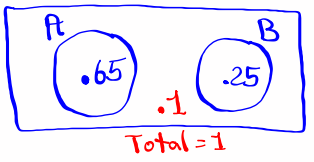
1) $P(\bar{A}) = 1 - P(A) = 1 - .65 = \boxed{.35}$

2) $P(\bar{B}) = 1 - P(B) = 1 - .25 = \boxed{.75}$

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

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = .65 + .25 - 0 = \boxed{.9}$

5) Construct Venn Diagram



Apr 5-9:30 AM

$P(A) = .45$

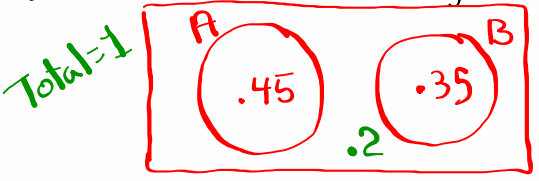
$P(B) = .35$

A & B are disjointed events

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

Watch the Video De Morgan's Law, then do SG 11 ✓

1) Construct Venn Diagram



2) $P(\bar{A}) = 1 - P(A) = 1 - .45 = \boxed{.55}$

3) $P(\bar{B}) = 1 - P(B) = 1 - .35 = \boxed{.65}$

5) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = .45 + .35 - 0 = \boxed{.8}$

Apr 5-9:37 AM

Intro. to odds

odds in favor of event E are

$$a : b$$

a: # E happens

b: # $\bar{E}$ happens

odds against event E are $b : a$.

Apr 5-9:46 AM

I flipped a coin 250 times, it landed tails 100 times.

100 Tails

150 $\overline{\text{Tails}}$

odds in favor of landing tails are

100 : 150

we need to reduce.

100 ÷ 150 MATH 1:▶Frac Enter

2 : 3

odds against landing tails 3 : 2.

Apr 5-9:48 AM

Consider a standard deck of playing cards. 52 Cards, 26 Red, 12 face, 4 Aces

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

2) odds in favor of selecting ace.

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

4 : 48 → $\boxed{1:12}$

3) odds against selecting ace. ← Reverse it

$\boxed{12:1}$

Apr 5-9:53 AM

If odds are given for event E as a:b

$$P(E) = \frac{a}{a+b} \quad , \quad P(\bar{E}) = \frac{b}{a+b}$$

ex: odds in favor of event E are 3:13,

1) $P(E) = \frac{3}{3+13} = \boxed{\frac{3}{16}}$

2) $P(\bar{E}) = \frac{13}{3+13} = \boxed{\frac{13}{16}}$ ← Reverse it

3) odds against E. $\boxed{13:3}$

Apr 5-9:58 AM

If $P(E)$ is given,

odds in favor of event E are

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

Ex. Suppose $P(E) = .04$

1) $P(\bar{E}) = 1 - P(E)$
$= 1 - .04$
$= .96$

SG 12
1 - 6 ✓

2) odds in favor of event E.
$P(E) : P(\bar{E})$
$.04 : .96 \rightarrow 1 : 24$

3) odds against event E.
$24 : 1$

Apr 5-10:02 AM

TI instructions

! Factorial

$n! = n(n-1)(n-2)(n-3)\cdots 3\cdot 2\cdot 1$

$5! = 5\cdot 4\cdot 3\cdot 2\cdot 1 = 120$

5 MATH → PRB ↓ 4:! Enter 120

Find 50!

$\approx 3.04 \times 10^{64}$

50 MATH PRB 4:! Enter E64

Find 100!

100 MATH PRB 4:! Enter overflow

Apr 5-10:09 AM

$_nC_r$

n items

Choose r of them in any order

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

$$_5C_2 = \frac{5!}{2!\cdot(5-2)!}$$

$$= \frac{5!}{2!\cdot 3!}$$

$$\frac{5\cdot 4^{2}\cdot 3\cdot 2\cdot 1}{2\cdot 1\cdot 3\cdot 2\cdot 1}$$

$= 10$

5 MATH PRB 3:$_nC_r$ 2 Enter

Find $_{12}C_5$

12 MATH PRB 3:$_nC_r$ 5 Enter

792

Apr 5-10:14 AM

10 People, Choose 4 of them in any order. How many ways can this be done?

$_{10}C_4 = 210$

CA Lotto → 50 Numbers, Choose 5 Numbers in any order.

How many ways can this be done?

$_{50}C_5$ 2,118,760

Apr 5-10:20 AM

Consider the chart below

L1	L2
1	.2
2	.5
3	.3

Clear all lists

Make L1 & L2 like the chart

Use 1-Var Stats with L1 & L2

L1 ↑ List, L2 ↑ FreqList

$\bar{x} = 2.1$

S_x: blank

$n = 1$

Apr 5-10:25 AM

Complete the chart below

x	$P(x)$	$x \cdot P(x)$	$x^2 \cdot P(x)$
1	.1	.1	.1
2	.3	.6	1.2
3	.5	1.5	4.5
4	.1	.4	1.6

Clear all lists

$x \to L1$, $P(x) \to L2$

Use 1-Var Stats with L1 & L2

L1 ↑ List, L2 ↑ FreqList

$\bar{x} = 2.6$

S_x: Blank

$n = 1$

Apr 5-10:29 AM

use the chart below

x	P(x)
1	.05
2	.15
3	.25
4	.35
5	.2

$x \rightarrow L1$

$P(x) \rightarrow L2$

use 1-Var Stats with L1 & L2 to find

$\bar{x} = 3.5$

$S_x =$ Blank

$n = 5$

Apr 5-10:39 AM

use your calc to find

$$\frac{{}_4C_2 \cdot {}_6C_1}{{}_{10}C_3}$$ in reduced fraction.

$$= \frac{6 \cdot 6}{120} = \frac{36}{120} = \boxed{\frac{3}{10}}$$

Apr 5-10:43 AM

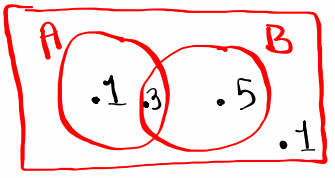
In-Person QZ 5

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

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

2) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .4 + .8 - .3 = \boxed{.9}$

3) Construct Venn Diagram.



Total = 1 ✓

Apr 5-10:47 AM