Statistics

Lecture 7

Feb 19-8:47 AM

S6 10 - 13

Intro. to Probabilities

E → Desired event (outcome)

P(E) → Prob. that event E happens

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

Acceptable forms of answer

1) Reduced fraction

2) Rounded to 3-decimal places

3) Scientific Notation

Jan 23-4:33 PM

A class has 15 females and 10 male students. If we randomly select one person, find the prob. that we select

a) a female

$$P(\text{Female}) = \frac{\text{Total \# of females}}{\text{Total \# of Students}} = \frac{15}{25} = \boxed{\frac{3}{5}} = \boxed{.6}$$

b) a male

$$P(\text{Male}) = \frac{\text{\# males}}{\text{\# of all Students}} = \frac{10}{25} = \boxed{\frac{2}{5}} = \boxed{.4}$$

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A deck of playing cards has 40 cards, 25 red, 10 face cards, and 2 aces.

If we randomly select one card, find the prob. that our selection is

25 ÷ 40 Math 1:▶Frac

a) Red $P(\text{Red}) = \frac{25}{40} = \boxed{\frac{5}{8}}$

MATH 2:▶Dec Enter Enter

$= \boxed{.625}$

b) face card $P(\text{face}) = \frac{10}{40} = \boxed{\frac{1}{4}} = \boxed{.25}$

c) an ace. $P(\text{Ace}) = \frac{2}{40} = \boxed{\frac{1}{20}}$

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A fair die has 20 sides and is numbered

1, 2, 3, 4, 5, - - - -, 18, 19, 20

Roll it once, find the prob. that we get

1) less than 5
1, 2, 3, 4

P(less than 5) = $\frac{4}{20} = \boxed{\frac{1}{5}}$

2) at least 18
18, 19, 20

P(at least 18) = $\boxed{\frac{3}{20}}$

3) less than 5 or at least 18.
1, 2, 3, 4 18, 19, 20

P(less than 5 OR at least 18) = $\boxed{\frac{7}{20}}$

4) less than 5 and at least 18
1, 2, 3, 4 18, 19, 20

Do not use Ø for 0.

P(less than 5 and at least 18) = $\frac{0}{20} = \boxed{0}$

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I Surveyed 80 people, table below shows the result of the one question Survey.

"Do You Support - - - -"

	Yes	NO	Total
Males	10	20	30
Females	35	15	50
Total	45	35	80

If we randomly Select one of these people,

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

2) P(Yes) = $\frac{45}{80} = \boxed{\frac{9}{16}}$

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

Pay close attention to

4) P(Male or Yes) = $\frac{65}{80} = \boxed{\frac{13}{16}}$

Jan 23-4:54 PM

You attend a fundraiser. You buy a ticket for drawing. 5000 tickets are sold.

Find $P(\text{winning Ticket}) = \frac{1}{5000} = .0002$

$= 2 \times 10^{-4}$

Not calc. notation

2 E -4

Jan 23-5:04 PM

$E \rightarrow$ Desired event

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

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

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

Suppose $P(E) = .15$

$P(\bar{E}) = 1 - P(E) = 1 - .15 = .85$

Suppose $P(E) = \frac{5}{14}$

$P(\bar{E}) = 1 - P(E) = 1 - \frac{5}{14} = \frac{9}{14}$

1 [−] 5 [÷] 14 [MATH] [1:▶Frac] [Enter]

Jan 23-5:08 PM

A standard deck of playing cards has 52 cards and 4 aces.

Let's randomly draw one card,

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

2) $P(\overline{\text{ace}}) = 1 - P(\text{Ace}) = 1 - \frac{1}{13} = \boxed{\frac{12}{13}}$

Jan 23-5:13 PM

Some Prob. Rules & Terms:

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

2) Sum of $P(E) = 1$, $\sum P(E) = 1$

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

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

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

Suppose we randomly select one person, what is the prob. that he/she has a birthday today?

$\frac{1 \text{ day}}{365 \text{ Days}} = \frac{1}{365} \approx .003$ Rare event

what is the prob. that he/she has a birthay in this week?

$\frac{1 \text{ wk}}{52 \text{ wks}} = \frac{1}{52} = .019$ Rare event

SG 10 ✓

Jan 23-5:16 PM

Addition Rule:

Keyword OR

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

(A and B: both)

One Action event

$P(A) = .8$, $P(B) = .6$, $P(A \text{ and } B) = .5$

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

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

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

(addition Rule)

$= .8 + .6 - .5 = \boxed{.9}$

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$P(HB) = .7$

$P(FF) = .4$

$P(HB \text{ and } FF) = .25$

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

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

3) $P(HB \text{ or } FF) = P(HB) + P(FF) - P(HB \text{ and } FF)$

$= .7 + .4 - .25 = \boxed{.85}$

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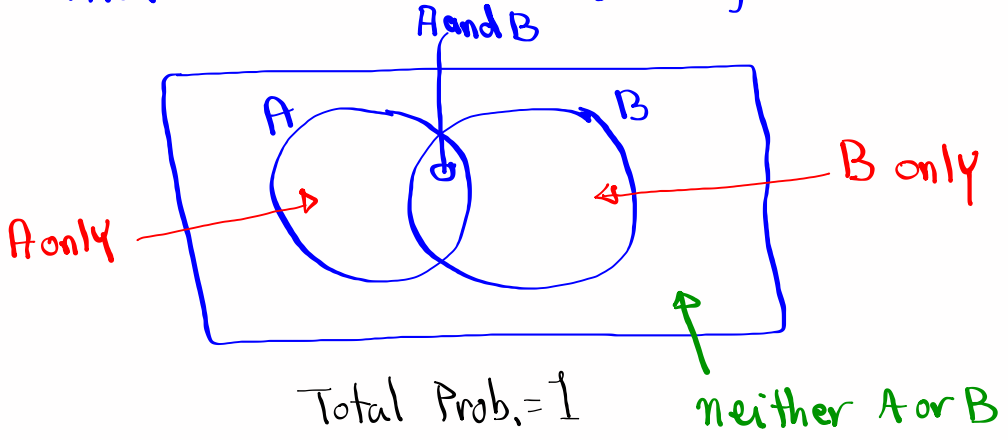
Addition Rule with Venn Diagram



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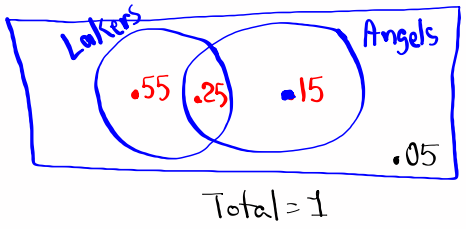
P(Lakers) = .8

P(Angels) = .4

P(Lakers and Angels) = .25

.8 − .25 = .55



.4 − .25 = .15

P(Lakers only) = .55

P(Angels only) = .15

P(Fan lakers, Angels, not both) = .55 + .15 = .7

P($\overline{\text{Lakers}}$) = .2

P($\overline{\text{Angels}}$) = .6

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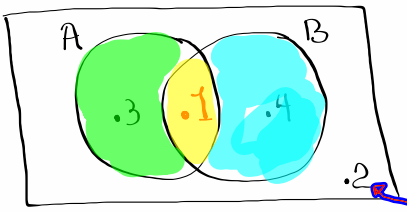
Complete the Venn Diagram below



Total = 1

.3 + .4 + .2 = .9

We are short .1

P(A only) = .3

P(B only) = .4

P(A) = .3 + .1 = .4

P(B) = .4 + .1 = .5

P(A and B) = .1 overlap

P(A or B) = P(A) + P(B) − P(A and B)

= .4 + .5 − .1 = .8

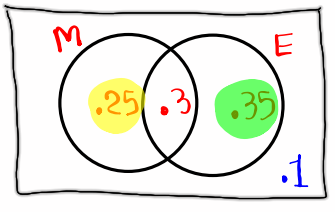
P(not A or B) = 1 − P(A or B) = 1 − .8 = .2

Jan 23-6:04 PM

P(Math) = .55

P(English) = .65

P(Math and English) = .3



Total = 1

P(Math only) = .55 − .3 = .25

P(English only) = .65 − .3 = .35

P(Math only OR English only) = .25 + .35 = .6 ✓

↑ addition Rule

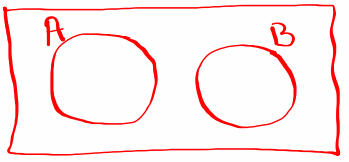
P(Math) + P(English) − 2 P(Math and English)

.55 + .65 − 2(.3) =

.55 + .65 − .6 = .55 + .05 = .6

Jan 23-6:09 PM

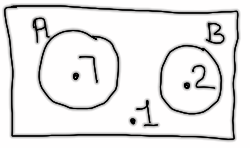
Events A and B are called **Mutually exclusive events** or disjoint events when they cannot happen together. $P(A \text{ and } B) = 0$



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

$P(A) = .7$ $\quad P(\bar{A}) = .3$

$P(B) = .2$ $\quad P(\bar{B}) = .8$



A and B are MEE $\rightarrow P(A \text{ and } B) = 0$

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

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

$.7 + .2 - 0 = .9$

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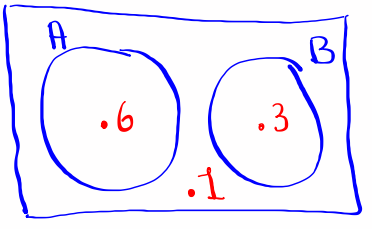
$P(A) = .6$

$P(B) = .3$

A and B are disjointed events.



Total = 1

$P(\bar{A}) = .4$ $\quad P(\bar{B}) = .7$

$P(A \text{ and } B) = 0$ $\quad P(A \text{ or } B) = .9$

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

SG 11

To the RHS of SG 10-13 watch the video called DeMorgan's Law

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Review of SG 9

x	y	x^2	y^2	xy
0	2	0	4	0
2	5	4	25	10
3	6	9	36	18
4	6	16	36	24
5	12	25	144	60

Clear all lists

2nd + 4:ClearAllLists Enter

$x \to L1$, $y \to L2$

STAT Edit

1:Edit

L1	L2
0	2
2	5
3	6
4	6
5	12

STAT → CALC

2: 2-Var Stats

xlist: L1

Ylist: L2

FreqList: Clear

Calculate

$\sum x = 14$ $\sum y = 31$

$\sum x^2 = 54$ $\sum y^2 = 245$

$n = 5$ $\sum xy = 112$

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Let's find

$a = 1.432$

$b = 1.703$

$r^2 = .813$

$r = .901$

If r & r^2 are missing

STAT → CALC

8:LinReg(a+bx)

xlist: L1

Ylist: L2

Clear

Calculate

2nd 0 ↓↓↓…↓ ▶Diagnostic On Enter Enter

Regression line → $y = 1.4 + 1.7x$ → $y = 1 + 2x$

Coef. of determination is r^2 (%)

$r^2 \approx 81\%$

81% of Y-values are explained by x-values.

19% are unexplained.

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Linear Correlation Coef. r

$-1 \le r \le 1$

When r is close to ± 1 $\Rightarrow$ Linear Correlation is Significant.

When r is close to 0 $\Rightarrow$ Linear Correlation is not Significant

Last example $\rightarrow$ $r = .901$ $\Rightarrow$ close to 1

$\Rightarrow$ Linear Correlation is Significant

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How to make Prediction

If r is Significant $\Rightarrow$ use regression line

If r is not Significant $\Rightarrow$ use $\bar{y}$

From Last example, Predict y when $x=4$

1) Assume r is Significant

use regression line

$y = 1 + 2x = 1 + 2(4) = \boxed{9}$

2) Assume r is not Significant

use $\bar{y}$ VARS 5: Statistics 5: $\bar{y}$ Enter $\bar{y} = 6.2$

Jan 23-6:49 PM

Given $n=8$, $\Sigma y = 125$, $\hat{y} = 4.5 + 3.2x$

Predict y if $x=6$

1) Assume r is Significant

$\hat{y} = 4.5 + 3.2(6) = \boxed{23.7}$

2) Assume r is not Significant.

use $\bar{y}$

$\bar{y} = \frac{\Sigma y}{n} = \frac{125}{8} = \boxed{15.625}$

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