

Statistics

Fall 2022

Lecture 13



Review:

1) Suppose $P(A) = 0.025$

a) write in %.

$$0.025 (100)\% = 2.5\%$$

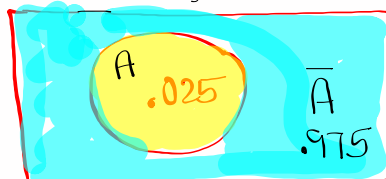
b) write in reduced fraction

$$.025 \text{ [Math] [1:] [Frac] [Enter]} \quad \frac{1}{40}$$

c) find $P(\bar{A}) = 1 - P(A)$

$$= 1 - .025 = .975$$

d) Construct Venn Diagram.



An 8-sided fair die is numbered
1, 2, 3, 4, 4, 4, 5, 6.

If we roll this die once, what is the
Prob. we get

1) 4 $\frac{3}{8}$

2) at most 4 $\frac{6}{8} = \frac{3}{4}$

3) at least 4 $\frac{5}{8}$

4) 3 or 4 $\frac{4}{8} = \frac{1}{2}$

5) 3 and 4. $\frac{0}{8} = 0$ Impossible event

Suppose

$P(A) = .3$

$P(B) = .8$

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

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

2) $P(\bar{B}) = 1 - P(B) = 1 - .8 = .2$

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

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 1 - .2 = .8$
 $= .3 + .8 - .2 = .9 \checkmark$

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

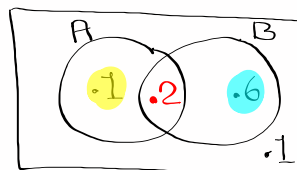
6) Construct Venn Diagram

$P(A \text{ only}) = P(A) - P(A \text{ and } B)$
 $= .3 - .2 = .1$

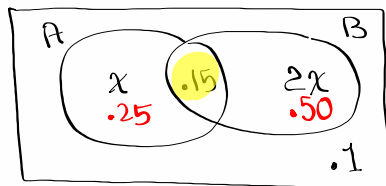
$P(B \text{ only}) = P(B) - P(A \text{ and } B)$
 $= .8 - .2 = .6$

7) $P(A \text{ only OR } B \text{ only})$

↳ Add $\rightarrow = .1 + .6 = .7$



Consider the Venn Diagram below



$$\text{Total} = 1$$

$$x + 0.15 + 2x + 0.1 = 1$$

$$3x + 0.25 = 1$$

$$3x = 1 - 0.25$$

$$3x = 0.75$$

$$x = 0.25$$

1) Find x

$$2) P(A) = 0.25 + 0.15 = 0.4$$

$$3) P(B) = 0.50 + 0.15 = 0.65$$

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

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

$$0.4 + 0.65 - 0.15 = 0.9$$

$$5) P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - 0.9 = 0.1$$

De Morgan's Law

$$6) P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - 0.15 = 0.85$$

$$P(A) = 0.25$$

$$P(B) = 0.55$$

A and B are

Mutually Exclusive Events.

Disjointed

$$1) P(\bar{A}) = 1 - 0.25 = 0.75$$

$$2) P(\bar{B}) = 1 - 0.55 = 0.45$$

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

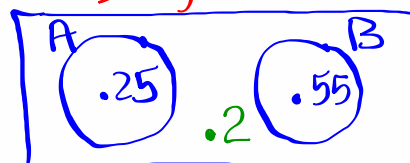
4) $P(A \text{ or } B)$

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

$$= 0.25 + 0.55 - 0$$

$$= 0.8$$

5) Construct Venn Diagram



$$\text{Total} = 1$$

Multiplication Rule

Keyword AND

Multiple - Action Event

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

A happens first, then B happens.

Independent Events

outcome of one event does not change the prob. of the next event.

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

$A \dot{\bar{e}} B$ are independent events.

Ex: $P(A) = .2$

$P(B) = .5$

$A \dot{\bar{e}} B$ are independent events.

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

$$P(\bar{B}) = 1 - .5 = \boxed{.5}$$

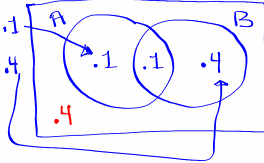
$$P(A \text{ and } B) = P(A) \cdot P(B) = (.2)(.5) = \boxed{.1}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \\ = .2 + .5 - .1 = \boxed{.6}$$

Construct Venn Diagram

$$P(A \text{ only}) = .2 - .1 = .1$$

$$P(B \text{ only}) = .5 - .1 = .4$$



$$P(A) = .4, \quad P(B) = .3,$$

$A \dot{\bar{e}} B$ are independent events

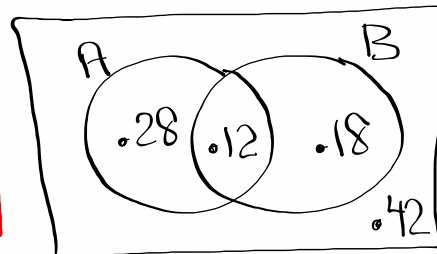
$$1) P(\bar{A}) = 1 - .4 = \boxed{.6}$$

5) Construct Venn Diagram

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

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

$$= P(A) \cdot P(B) = (.4)(.3) = \boxed{.12}$$



$$4) P(A \text{ or } B)$$

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

$$= .4 + .3 - .12 = \boxed{.58}$$

Suppose a loaded coin is tossed twice.

$$P(\text{Tails}) = .7, \quad P(\text{Heads}) = .3$$

TT

TH

HT

HH

Sample
Space

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

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

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

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

# Tails	P(# Tails)
2	.49
1	.42
0	.09

clear all lists

Reset all lists

Tails \rightarrow L1P(# Tails) \rightarrow L2

use 1-Var Stats L1, L2

$$\bar{x} = 1.4$$

S = blank

$$n = 1$$

P(at least 1 Tail)

$$= 1 - P(\text{No tails})$$

$$= 1 - .09 = \boxed{.91}$$

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

Each question has 4 choices with only
one correct choice.

$$P(C) = \frac{1}{4} \quad P(\bar{C}) = \frac{3}{4}$$

ccc

ccc

$$P(ccc) = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \boxed{\frac{1}{64}}$$

ccc

ccc

ccc

ccc

$$P(\bar{ccc}) = \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} = \boxed{\frac{27}{64}}$$

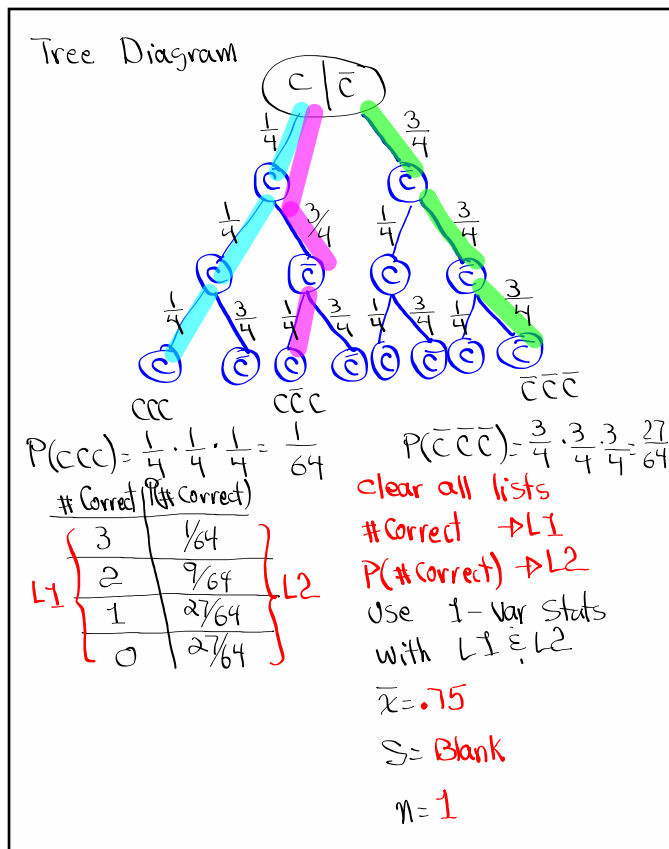
ccc

ccc

P(at least 1 correct answer)

$$= 1 - P(\text{No correct answer})$$

$$= 1 - \frac{27}{64} = \boxed{\frac{37}{64}}$$



Odds in favor of event E are
 $a : b$

odds against event E are $b : a$.

In a meeting of 400 people, there were
 120 females.

what are the odds in selecting a female?

$$\# \text{ Females} : \# \text{ Females}$$

$$120 : 280$$

$$120 \div 280 \quad \boxed{\text{Math}} \quad 1 : \text{Frac} \quad \boxed{\text{Enter}} \quad \frac{3}{7}$$

$$\boxed{3 : 7}$$

odds against $\Rightarrow 7 : 3$

$$P(\text{Select one female}) = \frac{3}{10}$$

Suppose odds for event E are $a:b$,

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

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

$$P(E) = \frac{1}{1+39} = \frac{1}{40} \quad P(\bar{E}) = \frac{39}{1+39} = \frac{39}{40}$$

Start working on SG 12

Watch all videos on the Right side
of SG 10-13.

Class QZ 11:

Given $P(A) = .7$, $P(B) = .4$, $P(A \text{ and } B) = .3$

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

$$2) P(A \text{ or } B) = .7 + .4 - .3 = .8$$

3) Construct Venn Diagram

