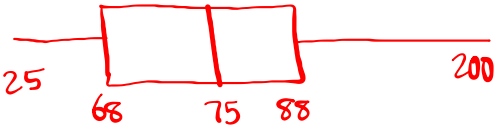
Math 110
Winter 2021
Lecture 7

Class QZ 4

A Sample has the following 5-Number Summary

25, 68, 75, 88, 200

1) Draw Box Plot



2) $IQR = Q_3 - Q_1 = 20$

3) Upper Fence

$UF = Q_3 + 1.5(IQR) = 118$

4) Lower Fence

$LF = Q_1 - 1.5(IQR) = 38$

5) Discuss outliers 25 to 38 or 118 to 200

A box contains 4 Red, 6 white, and 10 Blue balls.

If we randomly select one ball, find

1) $P(\text{Red}) = \frac{4 \text{ Red}}{20 \text{ Balls}} = \frac{4}{20} = \frac{1}{5} = .2$

2) $P(\text{white}) = \frac{6 \text{ white}}{20 \text{ Balls}} = \frac{6}{20} = \frac{3}{10} = .3$

3) $P(\text{Red or Blue}) = \frac{4 + 10}{20 \text{ Balls}} = \frac{14}{20} = \frac{7}{10} = .7$

4) $P(\text{white and Blue}) = \frac{0}{20 \text{ Balls}} = 0$

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

Complement Rule

1) Given $P(E) = .65$, Find $P(\bar{E}) = 1 - P(E) = 1 - .65 = .35$

2) Given $P(E) = \frac{3}{17}$, Find $P(\bar{E}) = 1 - P(E) = 1 - \frac{3}{17} = \frac{14}{17}$

1 − 3 a/b 17 Math 1: Enter

True or False

1) $P(A) = .725$ & $P(\bar{A}) = .375$ — False, $P(A) + P(\bar{A}) \neq 1$

2) ~~$P(A) = 1.4$~~ & ~~$P(\bar{A}) = -.4$~~ — False, $0 \leq P(E) \leq 1$

3) $P(A) = .5\%$ & $P(\bar{A}) = 99.5\%$ — True, $P(A) + P(\bar{A}) = 1$

$= .005$ & $= .995$

$0 \leq .005 \leq 1$ ✓ $0 \leq .995 \leq 1$ ✓

$.005 + .995 = 1$

A Fair Coin is tossed 3 times.

T → Tails

H → Heads

$P(T) = \frac{1}{2}$

$P(H) = \frac{1}{2}$

Sample Space

TTT	HTT
TTH	HTH
THT	HHT
THH	HHH

$P(3 \text{ tails}) = \frac{1}{8}$

$P(1 \text{ tail}) = \frac{3}{8}$

$P(2 \text{ Tails}) = \frac{3}{8}$

$P(0 \text{ Tails}) = \frac{1}{8}$

Addition Rule:

Keyword OR

Single Action event

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

A, B, or both — both of them

ex: $P(A) = .7$, $P(B) = .6$, $P(A \text{ and } B) = .55$

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

$= .7 + .6 - .55 = \boxed{.75}$

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

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

$P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = \boxed{.45}$

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

$P(HB) = .55$

$P(FF) = .48$

$P(HB \text{ and } FF) = .35$

1) $P(\overline{HB}) = 1 - P(HB)$
$= \boxed{.45}$

2) $P(\overline{FF}) = 1 - P(FF)$
$= \boxed{.52}$

3) $P(\overline{HB \text{ and } FF})$
$= 1 - P(HB \text{ and } FF)$
$= \boxed{.65}$

4) $P(HB \text{ or } FF)$
$= P(HB) + P(FF) - P(HB \text{ and } FF)$
$= .55 + .48 - .35$
$= \boxed{.68}$

5) $P(\overline{HB \text{ or } FF}) = 1 - .68 = \boxed{.32}$

When A & B cannot happen together,
They are called Mutually Exclusive Events (MEE) or
Disjoint event, and $P(A \text{ and } B) = 0$.

$P(A) = .7$, $P(B) = .2$, A & B are M.E.E., Find

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

2) $P(\overline{B}) = \boxed{.8}$

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

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .7 + .2 - 0$
$= \boxed{.9}$

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

Addition Rule with Venn Diagram:

$\Sigma P(E) = 1$

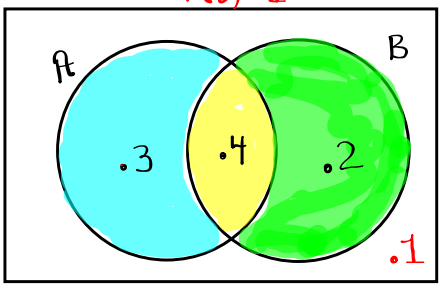
$P(A) = .7$

$P(B) = .6$

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

$P(A \text{ only}) = .7 - .4 = .3$

$P(B \text{ only}) = .6 - .4 = .2$



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

inside the Circles

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

outside of Circles

$P(\overline{A \text{ and } B}) = .6$

not in the overlap

$P(A \text{ only or } B \text{ only}) = .3 + .2 = .5$

$P(\text{Math}) = .65$

$P(\text{English}) = .75$

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

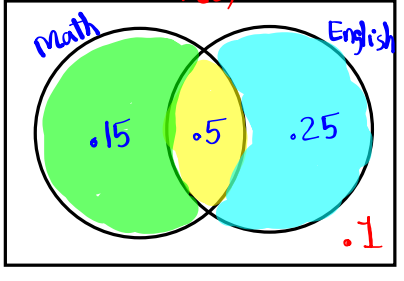
$P(\text{Math only}) = .65 - .5$

$P(\text{English only}) = .75 - .5$

$P(\overline{\text{Math}}) = .35$

Construct Venn Diagram

$\Sigma P(E) = 1$



$P(\overline{\text{English}}) = .25$

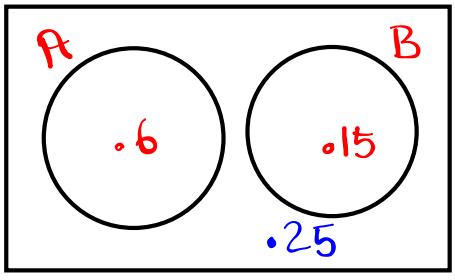
$P(\text{Math or English}) = .15 + .5 + .25 = .9$

$P(\overline{\text{Math or English}}) = .1$

$P(\text{Math only OR English only}) = .15 + .25 = .4$

$P(A) = .6$, $P(B) = .15$ A & B are disjoint events.

① Construct Venn Diagram



$\Sigma P(E) = 1$

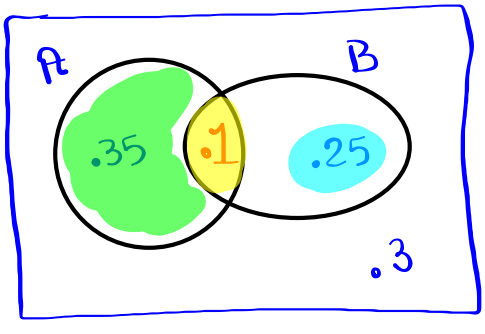
② $P(\overline{A}) = .15 + .25 = \boxed{.4}$

③ $P(\overline{B}) = .6 + .25 = \boxed{.85}$

4) $P(A \text{ or } B) = .6 + .15 = \boxed{.75}$

5) $P(\overline{A \text{ or } B}) = \boxed{.25}$

Complete the Venn Diagram below:



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

2) $P(A \text{ or } B) = .35 + .1 + .25 = \boxed{.7}$

3) $P(\overline{A}) = \boxed{.55}$

4) $P(\overline{B}) = \boxed{.65}$

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

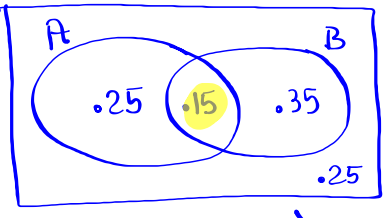
De Morgan's Law:

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

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

1) Verify the Venn Diagram

$.25 + .15 + .35 + .25 = 1$ ✓



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

$= P(\overline{A \text{ or } B}) = \boxed{.25}$

outside of circles

3) $P(\bar{A} \text{ or } \bar{B})$

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

$= .25 + .35 + .25 = \boxed{.85}$

Multiplication Rule:

Keyword AND

Multiple Action Event

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

A happens, then B happens

Given

A box has 3 Red & 7 Blue Balls.

I randomly Selected 2 balls.

$P(2 \text{ Red Balls})$

RR

$R\bar{R}$

$\bar{R}R$

$\bar{R}\bar{R}$

with replacement

$P(RR) = \frac{3}{10} \cdot \frac{3}{10} = \boxed{\frac{9}{100}}$

without replacement

$P(RR) = \frac{\cancel{3}^{1}}{\cancel{10}_{5}} \cdot \frac{\cancel{2}^{1}}{\cancel{9}_{3}} = \boxed{\frac{1}{15}}$

Standard deck of playing cards:

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

Draw 2 Cards

$P(\text{2 Reds}) = \frac{26}{52} \cdot \frac{26}{52} = \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{4}}$

with replacement

without replacement $\frac{26}{52} \cdot \frac{25}{51} = \boxed{\frac{25}{102}}$

$P(\text{2 Face Cards}) = \frac{12}{52} \cdot \frac{12}{52} = \frac{3}{13} \cdot \frac{3}{13} = \frac{9}{169}$

with replacement

without replacement $= \frac{12}{52} \cdot \frac{11}{51} = \boxed{\frac{11}{221}}$

12 ÷ 52 * 11 ÷ 51 Math 1: Enter

$P(\text{Draw 3 Aces without replacement}) = \frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50} = \boxed{\frac{1}{5525}}$

4 ÷ 52 * 3 ÷ 51 * 2 ÷ 50 Math 1: Enter 1.8×10^{-4}

Class QZ 5

Class limits	Class MP	Class F
20 – 30		7
31 – 41		13
42 – 52		15
53 – 63		5

1) Draw Freq. Polygon

2) Find

$\bar{x}$

s

} 3-decimals

s^2 in reduced fraction