Math 110
Winter 2021
Lecture 8

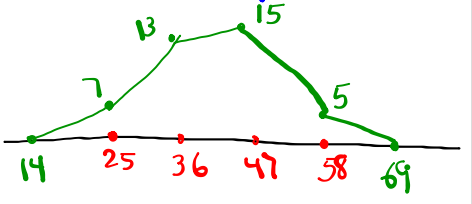
Class QZ 5

Class limits	Class MP	Class F
20 – 30	25	7
31 – 41	36	13
42 – 52	47	15
53 – 63	58	5

+11

MP → L1, Class F → L2

1) Draw Freq. Polygon



2) Find

$\bar{x} = 40.95$

$s = 10.256$

} 3-decimals

s^2 in reduced fraction

VARS 5: 3: Sx x^2 Math

1: Enter

$\frac{13673}{130}$

Multiplication Rule

Keyword AND

Multiple Action event

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

A happens first, then B happens

Given

Independent events: outcome of one event does not change the prob. of next event.

Flip a fair coin $\Rightarrow P(T) = \frac{1}{2}$, $P(H) = \frac{1}{2}$

Roll a fair die $\Rightarrow P(\text{get 5}) = \frac{1}{6}$

Multiple-choice exam $\Rightarrow$ Each question has 4 choices, but only one correct choice

$P(\text{guess correctly}) = \frac{1}{4}$

$P(\text{guess incorrectly}) = \frac{3}{4}$

New born babies $P(B) = .5$ & $P(G) = .5$

Draw multiple cards with replacement

$P(\text{First King}) = \frac{4}{52}$ $P(\text{Second King}) = \frac{4}{52}$

If A and B are independent events, then

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

A loaded coin is tossed twice.

$P(T) = \frac{1}{3}$, $P(H) = \frac{2}{3}$

T T

T H

H T

H H

$P(2 \text{ Tails}) = \frac{1}{3} \cdot \frac{1}{3} = \boxed{\frac{1}{9}}$

$P(1T \text{ \& } 1H) = P(TH \text{ or } HT)$

$= \frac{1}{3} \cdot \frac{2}{3} + \frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9} + \frac{2}{9} = \boxed{\frac{4}{9}}$

$P(\text{NO Tails}) = \frac{2}{3} \cdot \frac{2}{3} = \boxed{\frac{4}{9}}$

A deck of Cards with 40 Cards, has 15 Red, 10 face, and 3 aces.

Draw 2 Cards with replacement ✓

$P(\text{2 Red Cards}) = P(RR) = \frac{15}{40} \cdot \frac{15}{40} = \frac{3}{8} \cdot \frac{3}{8} = \boxed{\frac{9}{64}}$

$P(\text{2 face Cards}) = P(FF) = \frac{10}{40} \cdot \frac{10}{40} = \frac{1}{4} \cdot \frac{1}{4} = \boxed{\frac{1}{16}}$

$P(\text{2 Aces}) = P(AA) = \frac{3}{40} \cdot \frac{3}{40} = \boxed{\frac{9}{1600}}$

$P(\text{any student pass a Stat class}) = .7$

$P(\text{pass}) = .7 \qquad P(\overline{\text{pass}}) = .3$

2 students are randomly selected,

$P(\text{both pass}) = (.7)(.7) = .49$

$P(\text{one pass \& one } \overline{\text{pass}}) = (.7)(.3) + (.3)(.7) = \boxed{.42}$

$P\overline{P}$ OR $\overline{P}P$

$P(\text{Neither one pass}) = (.3)(.3) = \boxed{.09}$

$\overline{P}\,\overline{P}$

Consider a box that has 4 Dimes & 6 Nickels

Randomly draw 2 Coins

Sample Space

DD	DN	ND	NN
20¢	15¢	15¢	10¢

we draw without replacement

$$P(20¢) = P(DD) = \frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90}$$

$$P(15¢) = P(DN \text{ or } ND) = \frac{4}{10} \cdot \frac{6}{9} + \frac{6}{10} \cdot \frac{4}{9} = \frac{48}{90}$$

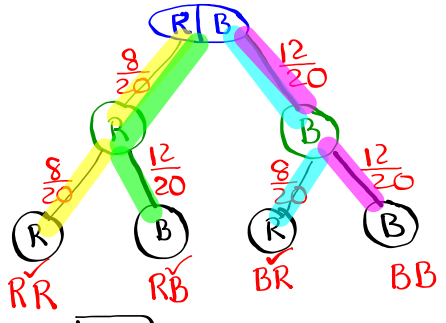
$$P(10¢) = P(NN) = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90}$$

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

Consider a deck of cards with 20 Cards, and 8 Red. 8 Red & 12 Black

Draw 2 Cards with replacement.

Tree Diagram



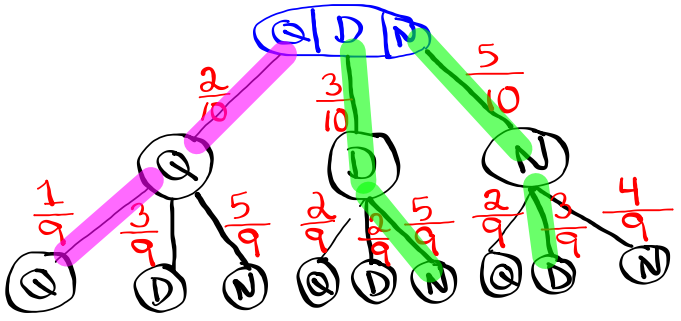
$$P(2 \text{ Reds}) = \frac{8}{20} \cdot \frac{8}{20} = \frac{64}{400}$$

$$P(1R \& 1B) = \frac{8}{20} \cdot \frac{12}{20} + \frac{12}{20} \cdot \frac{8}{20} = \frac{192}{400}$$

$$P(\text{No Reds}) = \frac{12}{20} \cdot \frac{12}{20} = \frac{144}{400}$$

A box 2 Quarters, 3 Dimes, and 5 Nickels.

Draw 2 Coins, NO replacement.



$P(50¢) = P(QQ) = \frac{2}{10} \cdot \frac{1}{9} = \frac{2}{90}$

$P(15¢) = P(ND \text{ or } DN) = \frac{3}{10} \cdot \frac{5}{9} + \frac{5}{10} \cdot \frac{3}{9} = \frac{30}{90}$

Given $P(A) = .6$, $P(B) = .5$ and A & B are independent events.

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

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

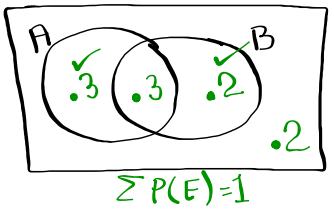
3) $P(A \text{ and } B) = P(A) \cdot P(B) = (.6)(.5) = \boxed{.3}$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
↑ Addition Rule
$= .6 + .5 - .3 = \boxed{.8}$

5) Construct Venn Diagram.

$.6 - .3 = .3$

$.5 - .3 = .2$



$P(HB) = .4$

$P(FF) = .7$

Assume HB & FF are independent events

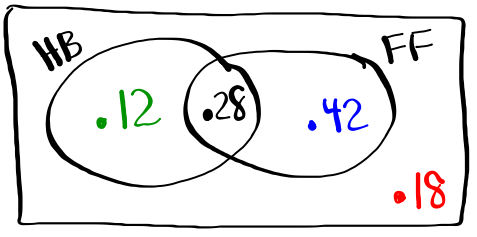
$P(HB \text{ and } FF) = P(HB) \cdot P(FF)$

$= (.4)(.7)$

$= .28$

$P(HB \text{ only}) = .4 - .28 = .12$

$P(FF \text{ only}) = .7 - .28 = .42$



$\Sigma P(E) = 1$

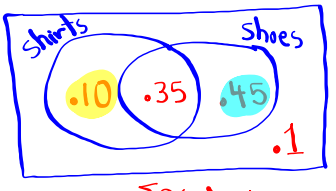
Alex is going shopping.

$P(\text{Shirts}) = .45$

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

$P(\text{Shirts and Shoes}) = .35$

1) Venn Diagram



$\Sigma P(E) = 1$

$P(\text{Shirts only OR Shoes only}) = .10 + .45$

$= .55$

Are shirts & shoes independent events?

$P(\text{Shirts and Shoes}) \stackrel{?}{=} P(\text{Shirts}) \cdot P(\text{Shoes})$

Not independent

$.35 \stackrel{?}{=} (.45)(.8)$

$.35 \stackrel{?}{=} .36$

Multiplication Rule

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

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

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

Conditional Prob.

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

$P(\text{Shoes}) = .6$

$P(\text{shirts and shoes}) = .5$

$$P(\text{shoes} \mid \text{shirts}) = \frac{P(\text{shirt and shoes})}{P(\text{shirts})}$$

$$= \frac{.5}{.8} = \frac{5}{8} = .625$$

$$P(\text{shirts} \mid \text{shoes}) = \frac{P(\text{shirts and shoes})}{P(\text{shoes})}$$

$$= \frac{.5}{.6} = \frac{5}{6} = .833$$

$P(\text{Math}) = .4$

$P(\text{Calc}) = .5$

$P(\text{Calc} \mid \text{Math}) = .8$

Find $P(\text{Math and Calc})$

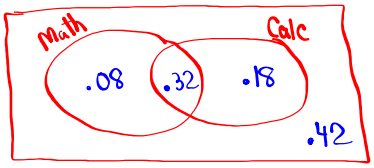
$$P(\text{Calc} \mid \text{Math}) = \frac{P(\text{Math and Calc})}{P(\text{Math})}$$

$$.8 = \frac{P(\text{Math and Calc})}{.4}$$

$P(\text{Math and Calc}) = (.8)(.4)$

$= .32$

$\sum P(E) = 1$



$.4 - .32 = .08$

$.5 - .32 = .18$

$P(\overline{\text{Math}} \text{ and } \overline{\text{Calc}}) = P(\overline{\text{Math or Calc}}) = .42$

De Morgan's Law

$P(\overline{\text{Math}} \text{ or } \overline{\text{Calc}}) = P(\overline{\text{Math and Calc}}) = .68$

Exam I:

Tuesday 2:45-4:50

Zoom ✓, Camera ✓, Mic. ✓ Not recording

SG 1 - 12