Unit 6 Day 3

6.3 Probability of Independent and Dependent Events

Independent Events:

when the outcome of the second event is NOT affected by the first event

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

Ex: Suppose a bag contains 7 marbles. There are 5 yellow and 2 green marbles. You draw a marble and put it back before drawing again. Find the probability that both marbles are yellow.

$$P(\text{both yellow}) = P(Y) \cdot P(Y)$$
$$5/7 \cdot 5/7 = \boxed{\frac{25}{49}}$$

Dependent Events:

when the outcome of the second event is affected by the first event

$$P(A, \text{then } B) = P(A) \cdot P(B \text{ after } A)$$

* assume the first draw was a success

Ex: Using the same bag of marbles as above, draw one marble but not replace it. Find P(both yellow) = P(Y) · P(Y after Y)

$$\frac{5}{7} \cdot \frac{4}{6} = \frac{20}{42} = \boxed{\frac{10}{21}}$$

Practice #1 and #2 on worksheet

Day 3: Independent and Dependent Events

Warm-up:

1. If you have a standard deck of cards in how many different hands exist of: 5 cards? 2 cards? (Show work by hand) $_{52}C_5$ 2,598,960 $_{52}C_2 = \frac{52 \cdot 51 \cdot 50 \cdot 49 \cdot 48}{5!} = \frac{52!}{(52-2)!\,2!} = \frac{2652}{2 \cdot 1} = 1326$
2. Pick a team of 3 people from a group of 10. $_{10}C_3 = 120$
3. Choose 3 desserts from a menu of 8 desserts. $_8C_3 = 56$
4. Choose a winner and a runner up from the 40 Miss Pickle Princess contestants. $_{40}P_2 = 1560$
5. Arrange the letters of the word FACTOR = $_6P_6 = 720$
6. Choose two jelly beans from a bag of 15? $_{15}C_2 = 105$
7. Assign the part of a play to the 4 lead characters from a group of 30 who tried out. $_{30}P_4$ 657720

Practice 1

Classifying Events as Dependent or Independent

1) Pick a cookie from the party platter. Then pick another cookie from the same platter. Dependent — 2nd pick is affected by the first

2) A number from 1 to 31 is selected at random. Then a month is selected at random. Independent — 2nd pick is not affected by the 1st

3) A grade level from K-12 is selected at random. Then one of the remaining grade levels is selected at random. Dependent — 2nd pick is affected by the first

4) Select a bag of chips at random from the pile. Change your mind and return it. Then pick another bag of chips at random. Independent — 2nd pick is Not affected by the 1st

Practice 2:

Calculating Probabilities of Independent and Dependent Events

A game board in your closet has 7 purple game pieces, 4 red game pieces, and 3 green game pieces. You randomly choose one game piece and then replace it. Then you choose a second game piece. Find each probability.

↳ independent events 14 total

1) P(red and green)

$P(R) \cdot P(G)$

$\frac{4}{14} \cdot \frac{3}{14} = \frac{12}{196}$

$\frac{3}{49}$

2) P(green and purple)

$P(G) \cdot P(P)$

$\frac{3}{14} \cdot \frac{7}{14} = \frac{21}{196}$

$\frac{3}{28}$

3) P(both red)

$P(R) \cdot P(R)$

$\frac{4}{14} \cdot \frac{4}{14} = \frac{16}{196}$

$\frac{4}{49}$

You are folding the socks from the laundry basket, which contains 6 brown socks, 2 blue socks, and 5 black socks. You pick one sock at a time and don't replace it. Find each probability. 13 total

4) P(blue, then black)

$P(\text{Blue}) \cdot P(\text{Black after Blue})$

$\frac{2}{13} \cdot \frac{5}{12} = \frac{10}{156} = \frac{5}{78}$

5) P(brown, then blue)

$P(\text{Brown}) \cdot P(\text{Blue after Brown})$

$\frac{6}{13} \cdot \frac{2}{12} = \frac{12}{156} = \frac{1}{13}$

6) P(both black)

$P(\text{Black}) \cdot P(\text{Black after Black})$

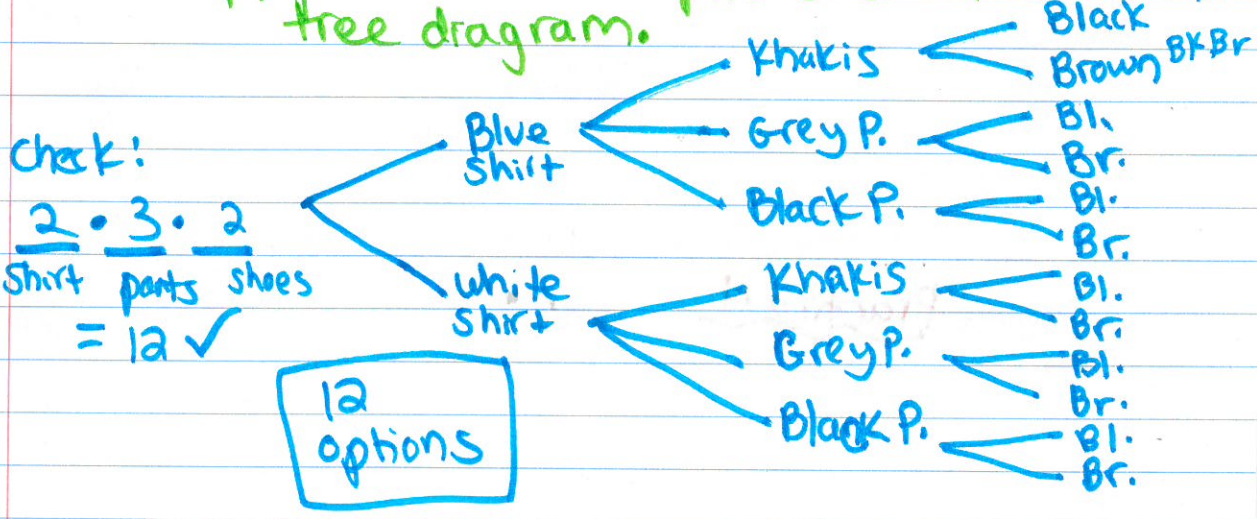
$\frac{5}{13} \cdot \frac{4}{12} = \frac{20}{156} = \frac{5}{39}$

Tree Diagrams:

A visual way to represent all of the possibilities for a scenario

Ex: How many outfits can you create from:
- 2 dress shirts - blue, white
- 3 dress pants - khaki, grey, black
- 2 dress shoes - brown and black

Represent the options with a tree diagram.



Check:

$\underline{2} \cdot \underline{3} \cdot \underline{2}$

Shirt pants shoes

$= 12$ ✓

12 options

Compound Event:

an event that is the result of more than one outcome

Ex: making the outfits (above)

Ex: What is the probability that you flip a tails, and roll a dice where you get evens?

For compound events
1st Draw tree diagram (label all probabilities)
2nd Multiply across the branches to get overall probabilities

12
12
24
36
48
60
72
84
96
108
120
132
144

To Calculate Probabilities for Compound Events

1st) Draw Tree Diagram (label ALL probabilities)

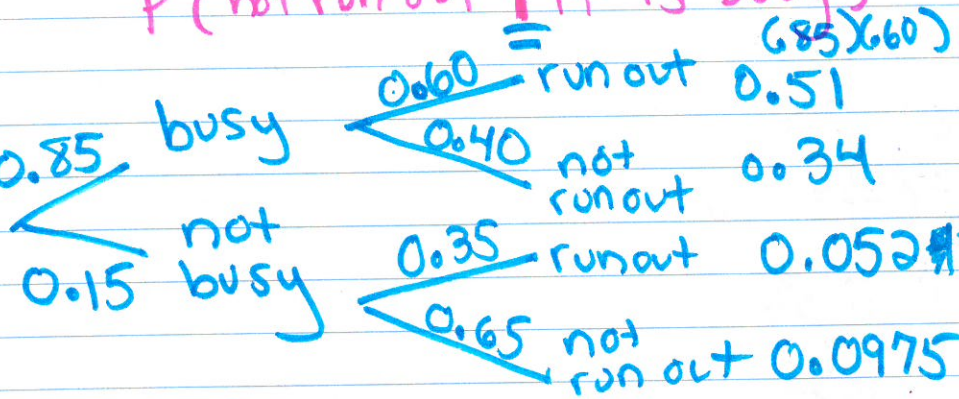
2nd) Multiply Across the Branches to find the overall probabilities

Ex: The local pizza shop employees find
- 85% of Friday nights are busy
- If it's busy, there's a 60% chance that they will run out of pepperoni
- When it is not busy, they run out of pepperoni 35% of the time

a) Create a Tree Diagram
b) Find P(busy & ran out of pepperoni)
c) Find P(ran out of pepperoni)
d) Calculate the probability of not running out given it is busy.

P(not run out | it is busy) =

a)



b) $(0.85)(0.60) = 0.51$ **51%**

c) $0.51 + 0.0525 = 0.5625$ **56.25%**

d) **40%** (busy) "zooming in" to branch

Practice #3 + 4

Extension! Practice #5

Practice 3

Ex 3: Fill in the remaining outcomes for Example 2 above. Then, calculate the probabilities for each outcome.

Outcome	Calculations	Probability	
Rain and Track Team Wins	(.60)(.70) = .42	42%	} sum 60%
Rain and Track Team Loses	(.60)(.30) = .18	18%	
No Rain and Track Team Wins	(.40)(.95) = .38	38%	} sum 40%
No Rain and Track Team Loses	(.40)(.05) = .02	2%	

Ex 4: What is the probability that the track team wins?

$P(\text{team win}) = P(\text{rain} + \text{win}) + P(\text{No rain} + \text{win})$

$= 42\% + 38\% = \boxed{80\%}$

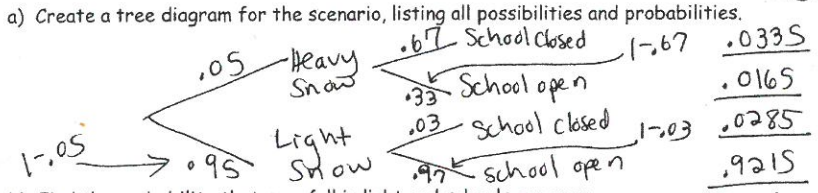
Practice 4

Ex 5: A student in Buffalo, New York, made the following observations:

- Of all snowfalls, 5% are heavy (at least 6 inches).
- After a heavy snowfall, schools are closed 67% of the time.
- After a light (less than 6 inches) snowfall, schools are closed 3% of the time.

You Try

a) Create a tree diagram for the scenario, listing all possibilities and probabilities.



check... totals to 1 (for 100%)

b) Find the probability that snowfall is light and schools are open.

$(.95)(.97) = .9215$ $\boxed{92.15\%}$

c) Find the probability that there is snowfall and schools are open.

$P(\text{heavy} + \text{open}) + P(\text{light} + \text{open}) = (.05)(.33) + (.95)(.97)$

$.0165 + .9215 = \boxed{93.8\%}$

d) Find P(schools open, given heavy snow).

$\boxed{33\%}$ "Zoom in" to heavy snow branch & find probability of school open off that