Cornell Notes	Topic/Objective: 3.3 Sample Space Diagrams and the Product Rule	Name:
		Class/Period: 4
		Date: 1/4/17

Essential Question: Finding Probabilities is easy if you Know $n(A)$ and $n(U)$

Questions:

$\underline{3} \cdot \underline{3} \cdot \underline{3} = 27$

$n(U) = 27$

Notes:

Recall: with Venn Diagrams, we Know $P(A)$, $P(B)$, $P(A \cap B)$, $P(A \cup B)$, $P(A)'$, ...

Probality of A $= \frac{n(A)}{n(U)}$
$P(A)$

Situations in which Venn diagrams are not helpful require a different approach:

Situation: A spinner (with equally-likely outcomes) is spun 3 times. The spinner has yellow, red and blue.
We need the total number of possible outcomes $n(U)$ (Sample Space)

<u>List all possibilities:</u> y - yellow r - red b - blue

yyy	yry	yrr	ybb
yyr	yby	yrb	ybr
yyb			
rrr	ryr	ryy	rby
rry	ryb	~~ryb~~ rbr	rbb
rrb			
bbb	byb	byy	bry
bbr	~~byr~~	byr	brr
bby			

Ex) $P(\text{exactly } 1 \text{ blue}) = \frac{13}{27}$

Questions:	Notes:

Sample Space Diagram:

Rolling two Dice. list the sample space

$6 \cdot 6 = 6^2$
$= 36$

		Die 1					
		1	2	3	4	5	6
	1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
Die 2	2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
	3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
	4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
	5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
	6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

$P(\text{Sum is odd}) = \frac{18}{36} = \frac{1}{2}$

3E p.79 #1,3,4

#4

	0	1	2	3	4	5
0	0,0	0,1	0,2	0,3	0,4	0,5
1	1,0	1,1	1,2	1,3	1,4	1,5
2	2,0	2,1	2,2	2,3	2,4	2,5
3	3,0	3,1	3,2	3,3	3,4	3,5
4	4,0	4,1	4,2	4,3	4,4	4,5
5	5,0	5,1	5,2	5,3	5,4	5,5

a. $P(\text{cards have same \#}) = \frac{6}{36} = \frac{1}{6}$

b. $P(\text{larger \# is prime}) = \frac{20}{36} = \frac{5}{9}$

~~1,0~~	2,0	3,0	5,0	5,4	3,5
~~0,1~~	1,2	3,1	5,1	0,5	4,5
0,2	1,2	3,2	5,2	1,5	
0,3	1,3	2,3	5,3	2,5	

Questions: | Notes: 3.3 (continued)

Product Rule for Independent Events

def) Two events are said to be independent if the outcome of one is not influenced by the other.

Ex) Choosing a card and flipping a coin.

Ex) Roll 1 6-sided die and toss 1 coin

Sample Space:

	1	2	3	4	5	6
H	(H,1)	(H,2)	(H,3)	(H,4)	(H,5)	(H,6)
T	(T,1)	(T,2)	(T,3)	(T,4)	(T,5)	(T,6)

$P(H) = \frac{6}{12} = \frac{1}{2}$

$P(\text{die is less than } 3) = \frac{4}{12} = \frac{1}{3}$

$P(H \text{ and die less than } 3) = \frac{2}{12} = \frac{1}{6}$

notice: $P(H \cap L) = P(H) \cdot P(L)$
(L = less than 3)
$= \frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$

When two events A and B are independent

$$P(A \cap B) = P(A) \cdot P(B)$$

If $P(A) \cdot P(B) = P(A \cap B)$, then A and B are independent

* The Product Rule for Independent events - also called the multiplication rule.

Questions:	Notes:
	Ex) One bag contains 3 red and 2 white balls. The other contains 1 red and 4 white. A ball is selected from each bag.
	R_1 = red from 1st bag
	R_2 = red from 2nd bag
	a) P(~~Both are red~~) $= \frac{4}{10} = \frac{2}{5}$
	Are they independent?
	$P(R_1) = \frac{3}{5}$
	$P(R_2) = \frac{1}{5}$
not necessary →	$P(R_1 \cup R_2)$ $P(R_1 \text{ and } R_2) = \frac{1}{5} + \frac{3}{5} = \frac{4}{5}$
	$P(R_1 \cap R_2) = \frac{1}{5} \cdot \frac{3}{5} = \frac{3}{25}$
	b) P(Both are different)
	1 $P(R_1)$ and $P(W_2)$
	$P(R_1) = \frac{3}{5}$ $P(W_2) = \frac{4}{5}$
	$P(R_1 \cap W_2) = \frac{3}{5} \cdot \frac{4}{5} = \frac{12}{25}$
	2 $P(W_1) = \frac{2}{5}$ $P(R_2) = \frac{1}{5}$
	$P(W_1 \cap R_2) = \frac{2}{5} \cdot \frac{1}{5} = \frac{2}{25}$
HW 3F p.82 1, 5, 9, 10 13	P(Both are different) $= \frac{12}{25} + \frac{2}{25} = \frac{14}{25}$
	c) P(At least one is white)
	* Sometimes it's easier to take 1 − (the complement)
	1 − P(Both red)
	$1 - P(R_1 \cap R_2)$
	$1 - \frac{3}{25} = \frac{25}{25} - \frac{3}{25} = \frac{22}{25}$