Homework Review - 13.3

18 $\quad {}_{10}C_8 = \frac{10!}{2!\,8!} = \frac{10\cdot 9}{2} = 45$ (combinations)

17 $\quad {}_{10}P_3 = \frac{10!}{7!} = 10\cdot 9\cdot 8 = 720$

Millionaire Airplane pilot Guy who sits in a vat of acid

23

6 main ingredients
pick 2

$${}_6C_2 = \frac{6!}{4!\,2!} = \frac{6\cdot 5}{2} = 15$$

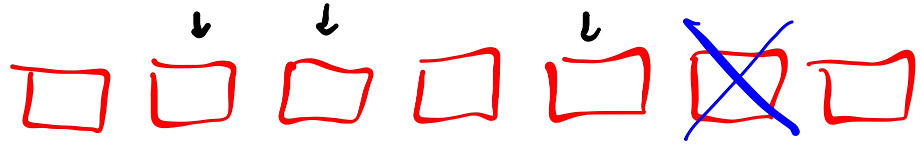
8 toppings
pick 3

$${}_8C_3 = \frac{8!}{5!\,3!} = \frac{8\cdot 7\cdot \cancel{6}}{\cancel{3}\cdot 2} = 56$$

$$\begin{array}{r} \overset{3}{5}6 \\ \times\ 15 \\ \hline 280 \\ 56 \\ \hline 840 \end{array}$$

840 different combos

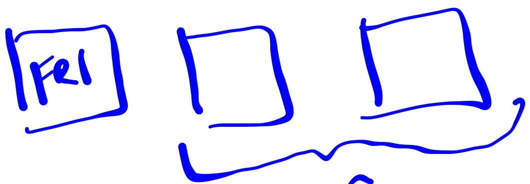
24



$$P = \frac{\text{\# ways I can work a Friday}}{\text{\# of 3 day shifts}}$$

$${}_7C_3 = \frac{7!}{4!\,3!} = \frac{7\cdot\cancel{6}\cdot 5}{\cancel{3\cdot 2}} = 35$$

$$\frac{15}{35} = \boxed{\frac{3}{7}}$$



${}_6C_2$

$${}_6C_2 = \frac{6!}{4!\,2!} = \frac{3\cancel{6}\cdot 5}{\cancel{2}} = 15$$

Finding Compound Probabilities:

A or B (Drop my pen or drop my hat)

A and B (eat a pizza and drink a soda)

What is a compound probability?

How do we find the number of possible outcomes?

- mutually exclusive events

If one thing happens, the other can't

(take a train or take a plane)

- overlapping events

Potentially both can happen

(take a plane or sit by a window)

Counting Mutually Exclusive Events

$$P = \frac{\text{\# of ways the event can occur}}{\text{\# of possible outcomes}}$$

How many ways can one event happen? (roll a 3)

$\boxed{3} = 1$

How many ways can the other event happen? (even #)

$\boxed{2}\ \boxed{4}\ \boxed{6} = 3$

Add them together ...

$1 + 3 = 4$ ways to roll a 3 or get an even #

Example: Roll a 3 or an even #

Counting Overlapping Events

(How many ways can A or B happen)

$\boxed{1}\ \boxed{3}\ \boxed{5} = 3$

How many ways can one event happen?

(odd #)

$\boxed{2}\ \boxed{3}\ \boxed{5} = 3$

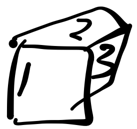
(2 overlaps)

How many ways can the other event happen? (prime #)

Add together and subtract the number of ways BOTH events can happen ...

$3+3-2 = 4$ ways to roll an odd # or a prime #

Example: Roll an $\underbrace{\text{odd \#}}$ or a $\underbrace{\text{prime \#}}$



Finding the Probability of A or B: $P = \frac{\#\text{ event occur}}{\text{sample space}}$

P(A or B)

4

How many ways can the condition be met (mutually exclusive or overlapping...)?

6

How many total outcomes are there?

P(Roll a 2 or Roll an odd #) =

$\frac{4}{6} = \frac{2}{3}$

Use the probability formula.

Example: Roll a 2 or an odd #

4 = 2 1,3,5

In Exercises 1–4, you draw a card from a bag that contains 4 yellow cards numbered 1–4 and 5 blue cards numbered 1–5. Tell whether the events A *and* B are *mutually exclusive* or *overlapping*. Then find *P*(A *or* B).

1. **Event A:** You choose a card with an even number. Y2, Y4, B2, B4
Event B: You choose a number 4 card. Y4 B4

2. **Event A:** You choose a yellow card.
Event B: You choose a number 5 card.

3. **Event A:** You choose a blue number 3 card. B3
Event B: You choose a blue card. B1 B2 B3 B4 B5

4. **Event A:** ~~You choose a card with an~~ odd number B1 B3 B5 Y1 Y3 5
Event B: ~~You choose~~ a blue card. 5 B1 B2 B3 B4 B5

10 − 3 = 7

Y1 Y2 Y3 Y4 B1 B2 B3 B4 B5

① Mutually exc. or overlapping?

② # ways event occurs

③ Probability of A or B

1	2	3	4
Ov.	M	Ov.	Ov.
4	5	5	7
$\frac{4}{9}$	$\frac{5}{9}$	$\frac{5}{9}$	$\frac{7}{9}$

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1. **Event A:** You choose a card with an even number.
Event B: You choose a number 4 card.

2. **Event A:** You choose a yellow card.
Event B: You choose a number 5 card.

3. **Event A:** You choose a blue number 3 card.
Event B: You choose a blue card.

4. **Event A:** You choose a card with an odd number.
Event B: You choose a blue card.

Event A: Y1, Y3, B1, B3, B5 = 5
Event B: B1, B2, B3, B4, B5 = 5

10
− 3
7

$$\frac{\text{\# of ways A or B can happen}}{\text{\# of possible outcomes}}$$

Y1, Y2, Y3, Y4
B1, B2, B3, B4, B5

9

$$\boxed{P(A \text{ or } B) = \frac{7}{9}}$$

	K	Q	Bsp	R	K	P
B	1	1	2	2	2	8
W	1	1	2	2	2	8

14 "A": choose a black piece

BK, $\boxed{BQ}$, BBsp, BR, BK, BP
1, 1, 2, 2, 2, 8 $= 16$

"B": choose a queen

$\boxed{BQ}$, WQ
1, 1

$= 2$

18
-1
17

$$P(A \text{ or } B) = \frac{17}{32}$$

246 887,403 households

270,658 : dog

326,591 : cat

81,641 : both

A : has dog

B : has cat

$$\frac{515{,}608}{887{,}403} \approx 58\%$$

$$\begin{array}{r} 270{,}658 \\ 326{,}591 \\ \hline 597{,}249 \\ -\ 81{,}641 \\ \hline 515{,}608 \end{array}$$

A: multiple of 3   3, $\boxed{6}$ = 2

B: even #   2, 4, $\boxed{6}$ = 3

$$\frac{4}{6} = \boxed{\frac{2}{3}}$$

P(A or B)

$$\begin{array}{r} 5 \\ -\ 1 \\ \hline 4 \end{array}$$

Independent vs. Dependent Events

5 red, 2 green
marbles in a bag = 7

P(A and B)

$\frac{5}{7}$ red $\frac{2}{7}$ green 1st

$\frac{5}{7}$ red $\frac{2}{7}$ green 2nd

$\frac{5}{7}$ red $\frac{2}{7}$ green 1st

$\frac{4}{6}$ red $\frac{2}{6}$ green $\frac{5}{6}$ red $\frac{1}{6}$ green 2nd

Independent event: one event has no effect on whether the other is likely to happen

ex. pick a marble & replace; pick another marble

Dependent event: one event CHANGES how likely another is to occur

ex. pick a marble; don't replace; pick another marble

AND P(A and B)

independent? dependent?

OR P(A or B)

mutually exclusive? overlapping?

Finding the Probability of A and B:

A: Pick a red marble

B: Pick a green marble

→ With replacement

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

$$\frac{10}{49} = \frac{2}{7} \cdot \frac{5}{7}$$

→ Without replacement

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

$$\frac{10}{42} = \frac{2}{7} \cdot \frac{5}{6}$$

Are the events independent or dependent?

Independent:

P(A and B) = P(A) * P(B)

Dependent:

P(A and B) = P(A) * P(B given A)

Example - 5 green, 2 red marbles in a bag!

A bag contains 6 red balls and 5 green balls. You randomly draw one ball, replace it, and randomly draw a second ball.

Event A: The first ball is green.

Event B: The second ball is green.

With replacement

independent

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

$$\frac{25}{121} = \frac{5}{11} \cdot \frac{5}{11}$$

$$\left(\frac{5}{11}\right)^2$$

You write each of the letters of the word BRIL~~L~~IANT on pieces of paper and place them in a bag. You randomly draw one letter, do not replace it, then randomly draw a second letter.

Event A: The first letter is an L.

Event B: The second letter is a T.

Without replacement

dependent

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

$$\boxed{\frac{1}{36}} = \frac{2}{72} = \frac{2}{9} \cdot \frac{1}{8}$$

Homework:

p. 864, 2-20 even, 23, 24

pt $\cancel{1}$: 2-6 even
14
18
24b

pt 2: 8-12 even
16
20
23
24a