Math 2 - Unit 6

$$\text{Probability} = \frac{\#\text{ of desired outcomes}}{\#\text{ of total outcomes}}$$

$$\text{Odds: } \frac{\#\text{ of desired outcomes}}{\#\text{ of not desired outcomes}}$$

example:
in a 30 person class, there are 10 girls.

$P(\text{girl}) = 10/30$ or $1/3$

Odds(girl) = 10:20
or 1 to 2

Fundamental Counting Principle:
* Repeats allowed *

ex: how many 7 digit phone numbers start with the number 2?

$\underset{\uparrow}{1} \cdot \underline{10} \cdot \underline{10} \cdot \underline{10} \cdot \underline{10} \cdot \underline{10} \cdot \underline{10}$

1 choice for first #

10 choices for the next 6 #'s

Permutation
* No Repeats *

$_nP_r = \frac{n!}{(n-r)!}$

order matters

ex: how many ways can 10 runners win 1st, 2nd & 3rd?

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

Combination
* No Repeats *

$_nC_r = \frac{n!}{(n-r)!\,r!}$

order is not important

ex: how many ways can 10 runners be on a committee of 3 representatives?

$_{10}C_3 = \frac{10!}{7!\,3!}$

↳ These tell you about # of total outcomes or sample space

A ∩ B
"overlap"
"A AND B"
area in both A and B

A ∪ B
"A or B"
area in only A, only B, and overlap

A^c = complement of A
"not in A"

$P(A^c) = 1 - P(A)$

Vocabulary:

Independent Events:
the outcome of 1 event does not affect the outcome of a 2nd event

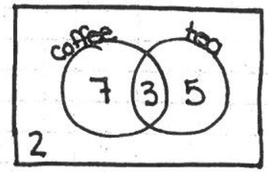
Dependent Events:
the outcome of 1 event affects the outcome of a 2nd

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$ ← $P(A|B)$ = probability of A "Given" B.

$$P(A \cap B) = P(A, \text{then } B) + P(B, \text{then } A)$$

ex: 1



a. P(tea) = ________

b. P(coffee) = ________

c. P(coffee ∩ tea) = ________

d. P(coffee ∪ tea) = ________

e. $P(\text{coffee})^c$ = ________

ex: 2

I have 4 red socks
1 blue sock
5 white socks

If I select a sock, put it back, then select a 2nd sock, find:

a. P(red, then blue) = ________

b. P(white, then red) = ________

c. P(red and white) = ________

d. P(2 red) = ________

ex: 3

I go to Moes for a taco☺. I can choose up to 5 toppings from 7 options. If I pick at least 1 topping, how many different tacos could I create?

____

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1 choice for first #

10 choices for the next 6 #'s

Permutation
* No Repeats *
$_nP_r = \dfrac{n!}{(n-r)!}$
order matters or different roles

ex: how many ways can 10 runners win 1st, 2nd & 3rd?

$_{10}P_3 = \dfrac{10!}{7!} = 10 \cdot 9 \cdot 8$

Combination
* No Repeats *
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order is not important or same role

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$P(A^c) = 1 - P(A)$

Vocabulary:

Independent Events:
the outcome of 1 event does not affect the outcome of a 2nd event

Dependent Events:
the outcome of 1 event affects the outcome of a 2nd

mutually inclusive!
two events that can occur at the same time

values in intersection

mutually exclusive!
two events that cannot occur at the same time

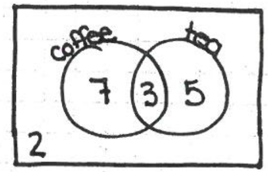
NO values in intersection

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A|B) = \dfrac{P(A \cap B)}{P(B)}$ ← $P(A|B)$ = probability of A "Given" B.

$P(A \cap B) = P(A, \text{then } B) + P(B, \text{then } A)$

ex: 1



17 total

a. P(tea) = $\boxed{8/17}$ $\quad \frac{3}{17} + \frac{5}{17}$ (T+C, just T)

b. P(coffee) = $\boxed{10/17}$ $\quad \frac{3}{17}$ T+C $+ \frac{7}{17}$ just C

c. P(coffee ∩ tea) = $\boxed{3/17}$
"and" → intersection

d. P(coffee ∪ tea) = $\boxed{15/17}$ $\quad \frac{7}{17} + \frac{5}{17} + \frac{3}{17}$ (only coffee, only T, C+T)

e. $P(\text{coffee})^c$ = $\boxed{\frac{7}{17}}$
not coffee
$\frac{5}{17} + \frac{2}{17}$ (T only, neither)

ex: 2

I have 4 red socks
1 blue sock
5 white socks

10 total

If I select a sock, put it back, then select a 2nd sock, find:

a. P(red, then blue) = $\boxed{1/25}$ $\quad \frac{4}{10} \cdot \frac{1}{10} = \frac{4}{100}$

b. P(white, then red) = $\boxed{1/5}$ $\quad 5/10 \cdot 4/10 = 20/100$

c. P(red and white) = $\boxed{2/5}$
$P(R,W) + P(W,R) = \frac{4}{10} \cdot \frac{5}{10} + \frac{5}{10} \cdot \frac{4}{10}$

d. P(2 red) = $\boxed{4/25}$
$P(R,R) = \frac{4}{10} \cdot \frac{4}{10} = \frac{16}{100}$

ex: 3

I go to Moes for a taco!! I can choose up to 5 toppings from 7 options. If I pick at least 1 topping, how many different tacos could I create? $\boxed{119}$

$_7C_1 + {_7C_2} + {_7C_3} + {_7C_4} + {_7C_5}$

$7 + 21 + 35 + 35 + 21$