Theoretical Probability, Experimental Probability, and Odds

Theoretical Probability

- The theoretical probability of an event E is the ratio of the ways the event can occur to the total number of possibilities in the sample space.
- The sample space is the set of all possible outcomes for an event.

$$P_t(E) = \frac{\text{number of ways event can occur}}{\text{total number of possibilities}}$$

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  - Sample Space:

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    =

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    $= \frac{1}{2}$

Theoretical Probability

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    =

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  - $P_t(T) = \frac{\text{number of ways exactly one tail appears}}{\text{total number of possibilities}}$

    $= \frac{3}{8}$

Theoretical Probability

- If we roll a die, what is the theoretical probability of getting 5?
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Theoretical Probability

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  - Sample Space: {1, 2, 3, 4, 5, 6}
  - $P_t(T) = \frac{\text{number of ways a 5 can appear}}{\text{total number of possibilities}}$

    =

Theoretical Probability

- If we roll a die, what is the theoretical probability of getting 5?
  - Sample Space: {1, 2, 3, 4, 5, 6}
  - $P_t(T) = \frac{\text{number of ways a 5 can appear}}{\text{total number of possibilities}}$
    $= \frac{1}{6}$

Theoretical Probability

- If we roll a die 2 times, what is the theoretical probability of getting two 1's?
  - Sample Space:

Theoretical Probability

- If we roll a die 2 times, what is the theoretical probability of getting two 1's?
  - Sample Space: {11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 51, 52, 53, 54, 55, 56, 61, 62, 63, 64, 65, 66}
  - $P_t(T) = \frac{\text{number of ways two 1's can appear}}{\text{total number of possibilities}}$
    $=$

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  - Sample Space: {11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 51, 52, 53, 54, 55, 56, 61, 62, 63, 64, 65, 66}
  - $P_t(T) = \frac{\text{number of ways two 1's can appear}}{\text{total number of possibilities}}$
    $= \frac{1}{36}$

Experimental Probability

- The experimental probability of an event E is the ratio of the number of times the event occurs to the total number of trials.

$$P_e(E) = \frac{\text{number of times event occurs}}{\text{total number of trials}}$$

Experimental Probability

- If we flip a penny 5 times, what is the experimental probability of getting tails when you flip a coin?

Flip 1	
Flip 2	
Flip 3	
Flip 4	
Flip 5	

$$P_e(\text{tails}) = \frac{\text{\# tails}}{5}$$

Experimental Probability

- If we flip a penny 25 times, what is the experimental probability of getting tails when you flip a coin?

Flip 1	
Flip 2	
. .	. .
Flip 25	

$$P_e(\text{tails}) = \frac{\text{\# tails}}{25}$$

Experimental Probability

- If we roll a die 5 times, what is the experimental probability of getting 3 when you roll the die?

Roll 1	
Roll 2	
Roll 3	
Roll 4	
Roll 5	

$$P_e(3) = \frac{\text{\# of 3's}}{5}$$

Experimental Probability

- If we roll a die 25 times, what is the experimental probability of getting 3 when you roll the die?

Roll 1	
Roll 2	
. .	. .
Roll 25	

$$P_e(3) = \frac{\text{\# of 3's}}{25}$$

Odds

- The odds of an event occurring is the ratio of the number of ways an event can occur (successes) to the number of ways the even cannot occur (failures).

$$\text{Odds(of event)} = \frac{\text{number of successes}}{\text{number of failures}}$$

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$$= \frac{25}{175} = \frac{1}{7}$$

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    - Odd(nickel) = 1/7
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$$= \frac{100}{100} = 1$$

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    $= \frac{8}{12} = \frac{2}{3}$