Warm-Up: A red die and a blue die are rolled. Let A be the event that the red die rolls 2, let B be the event that the sum of the rolls is 5, and let C be the event that the sum of the rolls is 7. Are A and B independent events? How about A and C?

$$P(A) = \frac{1}{6}$$

sum of 2 dice

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

$$P(A \mid B) = \frac{1}{4}$$

$P(A) \neq P(A \mid B)$, so events A and B are dependent

$P(A \mid C) = \frac{1}{6} = P(A)$, so events A and C are independent

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$\underbrace{HHH\ldots H}_{k}\ \underbrace{TTT\ldots T}_{n-k}$ probability $p^k(1-p)^{n-k}$

$HT\ \underbrace{HH\cdots H}_{k-1}\ \underbrace{TT\cdots T}_{n-k-1}$ probability: $p(1-p)\,p^{k-1}(1-p)^{n-k-1} = p^k(1-p)^{n-k}$

$HTHTHTHHTTT$ probability: $p^k(1-p)^{n-k}$

k Heads

$n-k$ Tails

How many arrangements of k heads and $n-k$ tails?

choose k of them to be Heads in $\binom{n}{k}$ ways

$$\underbrace{\_\ \_\ \_\ \_\ \_\ \_\ \_\ \_\ \_}_{n \text{ blanks}}$$

$$\boxed{\text{Answer to 2(c): } \binom{n}{k} p^k (1-p)^{n-k}}$$

Mutually exclusive (or disjoint): can't both happen simultaneously

If A and B are mutually exclusive, then $P(A \cap B) = 0$.