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Binomial Probability Distribution

- A fixed number of observations (trials), n
- e.g., 20 tosses of a coin
- Binary random variable
- e.g., Head or tail in coin toss
- Often called as success or failure
- Prob of success is p, and prob of failure is 1-p
- Constant probability for each observation

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Binomial example

Take the example of 5 coin tosses

What's the probability that you flip exactly 3 heads in 5 coin tosses?

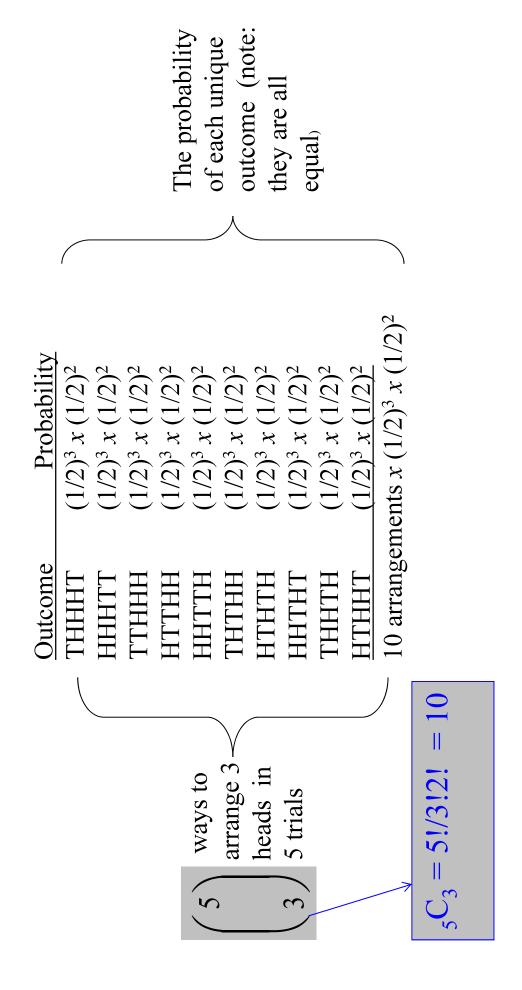
Binomial distribution

- Solution:
- One way to get exactly 3 heads: HHHTT
- What's the probability of this exact arrangement?
- P(heads) x P(heads) x P(tails) x P(tails) $= (1/2)^3 \times (1/2)^2$
- Another way to get exactly 3 heads: THHHT
- Probability of this exact outcome = $(1/2) \times (1/2)^3 \times (1/2)$ $= (1/2)^3 \times (1/2)^2$

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Binomial distribution

- unique outcome that has exactly 3 heads and 2 In fact, $(1/2)^3 \times (1/2)^2$ is the probability of each
- for as many unique arrangements as there are So, the overall probability of 3 heads and 2 tails is: $(1/2)^3 \times (1/2)^2 + (1/2)^3 \times (1/2)^2 + (1/2)^3 \times (1/2)^2 +$
- But how many are there??



:.P(3 heads and 2 tails) =
$$\binom{5}{3} \times P(heads)^3 \times P(tails)^2$$

 $= 10 \times (\frac{1}{2})^{5} = 31.25\%$

$$(5) = (3) \times P(he)$$

Binomial distribution, generally

possible outcomes (call them 1/0 or yes/no or success/failure) in n independent trials, then the probability of exactly X "successes"= Note the general pattern emerging → if you have only two

