Binomial (Bernoulli) Trials

- Experiments that have just two outcomes are the simplest, but they occur in many applications.
- Some applications you might use binomial probability with:
  - Tossing a coin
  - Drug trials
  - Quality control
  - Surveys

Examples of binomial trials:
1. Toss a coin and observe the outcome, heads or tails.
2. Administer a drug to a sick individual and classify the reaction as "effective" or "ineffective."
3. Manufacture a light bulb and classify it as "nondefective" or "defective"

Binomial Trials: Success/Failure

- An experiment with just 2 outcomes is called a binomial trial (or Bernoulli trial).
- One outcome is labeled a success and the other is labeled a failure.
- Note: "success" denotes the event we are interested in.
- If \( p \) is the probability of success, then \( q = 1 - p \) is the probability of failure.

Probability of \( k \) Successes

If \( X \) is the number of "successes" in \( n \) independent trials, where in each trial the probability of a "success" is \( p \), then

\[
\Pr(X = k) = \binom{n}{k} p^k q^{n-k}
\]

for \( k = 0, 1, 2, \ldots, n \) and \( q = 1 - p \).

Example

Each time at bat the probability that a baseball player gets a hit is .300. He comes up to bat four times in a game. Assume that his times at bat are independent trials. Find the probability that he gets
(a) exactly 2 hits and
(b) at least 2 hits.
Example

• A biased coin with \( P(H) = 0.25 \) and \( P(T) = 0.75 \) is thrown twice. What is the probability of getting two tails?

Example

• What is the probability that a family with 6 children will have exactly two girls?

Example

• A basketball player makes 60% of all foul shots that she tries. What is the probability that, in two foul shots, she makes at least one?