BINOMIAL PROBABILITY DISTRIBUTION \( B(n, p) \)

**Binomial experiment** must satisfy the following conditions:

1. There must be a fixed number of trials.
2. Trials must be independent, i.e. one trial’s outcome cannot affect the probabilities of other trials’ outcomes.
3. All outcomes of trials must be in one of two categories called success and failure.
4. Probabilities must remain constant for each trial.

\( n = \) number of trials  
\( p = \) probability of success in any given trial,  
\( q = \) probability of failure in any given trial.

**PROBABILITY OF \( x \) SUCCESSES IN \( n \) BINOMIAL TRIALS:**

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

**PROBABILITY OF AT LEAST \( x \) SUCCESSES IN \( n \) BINOMIAL TRIALS:**

\[
P(X \geq x) = 1 - \sum_{k=0}^{x-1} \binom{n}{k} p^{n-k} q^k
\]

**MEAN AND STANDARD DEVIATION**

\[
\mu = np  
\sigma = \sqrt{npq}
\]