The Binomial Probability Model
James Mortimer, Ph.D.

\[ \frac{n!}{x!(n-x)!} = \frac{3!}{2!1!} = 3 \]

Binomial Distribution
Notation:
\( n = \) number of times process is replicated,
\( p = P(\text{success}) \),
\( x = \) number of successes of interest

\[ 0 \leq x \leq n \]

\[ P(x \text{ successes}) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x} \]

Interpreting the Equation
\[ \frac{n!}{x!(n-x)!} = \frac{3!}{2!1!} = 3 \]
Binomial Distribution

Notation:
- n = number of times process is replicated,
- p = P(success),
- x = number of successes of interest

\[ P(x \text{ successes}) = \frac{n!}{x!(n-x)!}p^x(1-p)^{n-x} \]

Therefore,

\[ P(2) = 3 \cdot (p^2(1-p)^3) \]

If the probability of a success is .5, what is the probability that in a sample of size 6 that 1 or fewer successes will occur?

Calculate this probability and select from one of the following 4 possible answers:

A .109
B .016
C .094
D .05

Then move on the next slide to see if you are correct.
The Correct Answer is A. We obtain this probability by adding two probabilities: the probability of exactly 1 success in the sample of 6 and the probability of exactly 0 successes in this sample.

\[ P(1) = \binom{6}{1}/6!/(0.5^1)(0.5^5) = 0.09375. \]

\[ P(0) = \binom{6}{0}/6!/(0.5^0)(0.5^6) = 0.01563 \]

\[ P(1) + P(0) = 0.09375 + 0.01563 = 0.109 \]

In the same sample, what is the probability of 2 or more successes?

Move to the next slide to see the answer.

Because the probability of 1 or fewer successes is .109, the probability of 2 or more successes must be:

\[ 1 - \text{(probability of 1 or fewer successes)} = 1 - 0.109 = 0.891 \]