In a binomial experiment, there are n independent trials with each trial having only two possible outcomes: success and failure. The probability of success is the same for each trial.

Finding a Binomial Probability

For a binomial experiment consisting of n trials, the probability of exactly k successes is:

$$P(k \text{ successes}) = {}_nC_k\, p^k (1-p)^{n-k}$$, where p = probability of success on each trial and $1-p$ = probability of failure.

Example: A scientist claims that 40 % of mice used in an experiment will become very aggressive after having been administered an experimental drug. Suppose you randomly select 8 mice.

a) What is the probability that exactly 5 of them show aggressive behavior?

$n=8$
$k=5$
$p=.40$
$1-p=.60$

$${}_8C_5 (.4)^5(.6)^3 \approx .124$$

56

b) What is the probability that at least 7 of them show aggressive behavior?

7 or 8

$${}_8C_7 (.4)^7(.6)^1 + {}_8C_8 (.4)^8(.6)^0 \approx .009$$

8 1

A **binomial distribution** shows the probabilities of all possible numbers of successes for an experiment. A **histogram** can be used to show the binomial distribution.

c) Make a histogram for the binomial distribution for this experiment. What is the most likely number of mice to become aggressive? 3

$1 \quad {}_8C_0 (.4)^0(.6)^8 \approx .017$ ✓

$8 \quad {}_8C_1 (.4)^1(.6)^7 \approx .090$ ✓

$\frac{8 \cdot 7}{2} \quad 28 \quad {}_8C_2 (.4)^2(.6)^6 \approx .209$

$56 \quad {}_8C_3 (.4)^3(.6)^5 \approx .279$

$70 \quad {}_8C_4 (.4)^4(.6)^4 \approx .232$

$\frac{8!}{5!3!} \quad 56 \quad {}_8C_5 (.4)^5(.6)^3 \approx .124$ ✓

$28 \quad {}_8C_6 (.4)^6(.6)^2 \approx .041$ ✓

$8 \quad {}_8C_7 (.4)^7(.6)^1 \approx .008$ ✓

$1 \quad {}_8C_8 (.4)^8 \approx .001$ ✓