Section 5.4 → Binomial Experiments.

Gathering categorical data is always a binomial experiment (in some way).

A binomial experiment has n trials (independent).
The trials each have 2 outcomes:
S = success, F = failure.

$p = P(S) = P(\text{success in a trial})$
$q = 1-p = P(F) = P(\text{failure})$

x = # of successes in n trials.

$P(x) = P(x \text{ successes})$ ← Depends on the number of ways we can get x successes.

$${}_nC_x = \frac{n!}{x!\,(n-x)!}$$ ← Counts the number of ways to get x successes.

Ex Toss Kerrich's coin, $n=4$ times. How many ways to get $x=2$ heads.

$${}_nC_x = {}_4C_2 = \frac{4!}{2!(4-2)!}$$
$$= \frac{\cancel{4}\cdot 3\cdot \cancel{2\cdot 1}}{\cancel{2}\cdot 1\cdot \cancel{2\cdot 1}} = 6$$

List Outcomes
HHTT, HTHT, HTTH,
~~HTHT~~ THTH, TTHH
THHT
6 ways

In General $P(x) = {}_nC_x\, p^x q^{n-x}$

$$P(x) = \underbrace{{}_nC_x}_{\text{ways to get } x \text{ successes}}\ p^{x}\ q^{n-x}$$

x successes
$n-x$ failures
Prob. of failure
p = probability of success