C7C  **Sample-Resample**  Estimate population in a hard-to-count situation (Fish in a lake)
Tag all subjects in sample1 and release into population.
Count those with tags in sample2.

<table>
<thead>
<tr>
<th>Sample1</th>
<th>Sample2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tagged</td>
<td>T1</td>
</tr>
<tr>
<td>No tag</td>
<td>XXXXXX</td>
</tr>
<tr>
<td>Sample</td>
<td>N</td>
</tr>
</tbody>
</table>

Assume1: Tagged subjects mix randomly in entire population
Assume2: Sample2 is a random sample from entire population

Proportional reasoning:
- \( \frac{\text{# tagged}}{\text{# in population}} = \text{fraction observed in 2nd sample} \)
- \( \frac{T1}{N} = \frac{T2}{N2} \)
- \( \frac{\text{# in population}}{\text{# in 1st sample divided by fraction in 2nd sample}} = \frac{T1*(N2/T2)}{N} \)

C7D  **Sensitive-question survey so that those answering honestly are not identifiable.**
Group membership is random and known only to the individual.
Those in group 1 agree to say Yes regardless of whether that is true.  \#No in Group1 = 0
Those who find themselves in group 2 agree to answer honestly.  (Concealed by group1)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Group1</th>
<th>Group2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>**</td>
</tr>
</tbody>
</table>

1. Observe & count Yes and No
2. Infer Group1 = Group2 = N/2
3. Calculate *, **, and ***:
   - \( * = (N/2) \)
   - \( ** = \#No \)
   - \( *** = (N/2) - \#No = \#Yes - (N/2) \)

N = Number in both groups combined

C7G  **Confidence Intervals: Estimate the interval for the population statistics**
CI = sample mean (proportion) ± Margin of error (sampling variation)
ME = Margin of [sampling] error  
\( n \) is the size of the sample

- ME (measurements) = \( 2 \times s / \sqrt{\text{n}} \) where \( s \) is standard deviation
- ME (proportions) = \( 2 \times \sqrt{p(1-p)/\text{n}} \) where \( p \) is Assume p = 1/2
- Conservative ME (proportion) = \( 1 / \sqrt{\text{n}} \)

Note: Don’t mix percentages and decimal fractions. Use the latter!!!

C7I  **Required Sample Size so Margin of Error is Less than M**

- For measurements  
  \( n = (2 \times s / M)^2 \)
- For proportions  
  \( n = [4 \times p \times (1-p)] / M^2 \)
  
  \( n = 1 / M^2 \) using conservative estimate.

C7J & C7L  **Statistical Significance: Difference in population statistics is likely to be real (not chance).**

- * If confidence intervals do not overlap or touch, difference is statistically significant
- * If confidence intervals overlap or touch, difference is NOT statistically significant

Note: Statistically significant does not mean "important"
Statistically-significant means difference is statistically unlikely (if due to chance)