Active Learning Exercise:
Bias in Promotions

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Learning Objective: Understand how simulations can be used to evaluate hypotheses.

A company is performing an evaluation of 25 employees, consisting of 10 women and 15 men. After the evaluation, the company promotes the 8 most qualified candidates in the group. Some of the male employees believe the company disproportionately selected female employees for promotion. The resulting promotions are given below.

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoted</td>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Not</td>
<td>5</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>15</td>
<td>25</td>
</tr>
</tbody>
</table>

1. First, let’s consider this based on intuition:
   (a) What proportion of the employees were promoted?
   (b) What proportion of female employees were promoted? Male employees?
   (c) Do you think promotion and gender are independent?

2. We want to determine if this promotion result could have occurred by chance, or if there was gender-bias. To do this we formally compare the observed promotion proportions.
   (a) Let $p_W$ and $p_M$ represent the promotion proportion for women and men respectively.
   (b) Compute the difference $p_W - p_M$. What value did you get?
   (c) What value would you expect if promotions were assigned randomly?
   (d) Do you think the observed difference in proportions was due to chance?

3. We will use a class simulation to evaluate the probability of this difference occurring through chance:
   - You have a bag with 25 balls; the 10 red balls are ‘female’, and the 15 yellow balls are ‘male’.
   - Randomly draw 8 balls from the bag; these are your 8 promoted employees.
   - Compute $p_W - p_M$ in this simulated data set, and record it on a piece of paper.
   - Repeat this process a total of 5 times.
   - Add your simulated results to the class dot plot on the board.

4. Based on the dot plot, could the promotion of 5 females have happened by chance? Can you conclude that there was gender-bias?