In 15.6, 15.4, and 15.10, use the Wilcoxon rank sum test.

15.4(8). Independent random samples of size \(n_1 = 20\) and \(n_2 = 25\) are drawn from nonnormal populations \(P_1\) and \(P_2\). The combined sample is ranked and \(T_1 = 252\). Determine if there is a significant difference between the two populations.

\[
T_1 = 252, \quad [T_{\text{min}}, T_{\text{max}}] = [3, 8] \quad \mu_T = T_{\text{mid}} = (T_{\text{min}} + T_{\text{max}})/2 = 3.5 \quad \alpha = .05, \quad z_{\alpha/2} = 1.645 \\
\sigma_T = \sqrt{n_2 T_{\text{mid}}/6} = 2.2, \quad z = 1.645, \quad n_2 T_{\text{mid}}/6 = 9, \quad p\text{-value} \approx 2 \times 10^{-3} \\
\text{Acceptance interval} = \mu_T \pm z_{\alpha/2} \sigma_T = [23, 22], \quad \text{Confidence interval} = T_1 + z_{\alpha/2} \sigma_T = [23, 22] \\
\]

Conclusion:

15.6(7). A memory drug is tested to see if it can improve the memories of senior males (S) aged 65-70 to a level equal to that of young males (Y) in their 20's. Nonsense syllables given to each male. Five minutes later count is taken of the number of syllables which could be recalled.

Is there a significant difference in the number of syllables recalled by the medicated seniors and the number recalled by the young males?

\[
Y: \quad 3, 6, 4, 8, 7, 1, 1, 2, 7, 8 \\
S: \quad 1, 0, 4, 1, 2, 8, 0, 2, 2, 3 \\
\]

Rank the data in increasing order. (Since \(n_1 = n_2\), either group can be population 1 and used for \(T_1\). Pick S)

<table>
<thead>
<tr>
<th></th>
<th>0.0</th>
<th>0.1</th>
<th>1.0</th>
<th>1.1</th>
<th>1.1</th>
<th>2.0</th>
<th>2.0</th>
<th>2.0</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>3</td>
<td>3.3</td>
<td>4.4</td>
<td>4.6</td>
<td>6.7</td>
<td>7.8</td>
<td>8.8</td>
<td>8.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.5</td>
<td>11.5</td>
<td>13.5</td>
<td>13.5</td>
<td>15.16.5</td>
<td>19.19.19</td>
<td>19.19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This problem is repeated from HW 33. But this time, use the Normal Approximation Theorem rather than the \(T\) distribution of Table 7. Use the equality null hypothesis rather than the inequality discussed in the lecture.

\[
[T_{\text{min}}, T_{\text{max}}] = [55, 155] \\
H_4: \quad S \neq \text{avg}Y, \quad H_0: \quad S = \text{avg}Y \\
T_1 = 81.5, \quad n_1 = 10, \quad n_2 = 10, \\
\]

This time, use normal approximation, not Table 7 for \(T_{\alpha/2}, T_{1-\alpha/2}\).

\[
\mu_T = T_{\text{mid}} = (T_{\text{min}} + T_{\text{max}})/2 = 98, \quad \sigma_T = \sqrt{n_2 T_{\text{mid}}/6} = 2.2, \quad z = 1.645, \quad \alpha = .05, \quad z_{\alpha/2} = 1.645 \\
\text{Acceptance interval} = \mu_T \pm z_{\alpha/2} \sigma_T = [81.5, 82.5] \\
\text{Confidence interval} = T_1 + z_{\alpha/2} \sigma_T = [81.5, 82.5] \\
\]

Conclusion:

15.10(6). Circuit boards made by company A are compared with those by company B. The mean time before failure of each board is measured in months. There are 8 boards from A and 10 from B with the mean times to failure listed below. Find the acceptance and confidence intervals. Test for a difference between the boards for A and for B.

You have two methods that apply, use the most accurate method.

<table>
<thead>
<tr>
<th>A</th>
<th>32</th>
<th>32</th>
<th>40</th>
<th>31</th>
<th>35</th>
<th>29</th>
<th>37</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>41</td>
<td>39</td>
<td>36</td>
<td>47</td>
<td>45</td>
<td>34</td>
<td>48</td>
<td>44</td>
</tr>
</tbody>
</table>

Ranking:

25 29 31 32 33 34 35 36 37 39 39 40 41 43 44 45 48 47 48

\[
P_1 = A?, \quad P_2 = B?, \quad n_1 = \_, \quad n_2 = \\
\text{Stated in terms of } P_1 \text{ and } P_2: \quad H_4: \quad H_0: \quad [T_{\text{min}}, T_{\text{max}}] = [9, 8] \quad T_{\text{mid}} = 98, \quad T_1 = 13.7 \\
\text{Acceptance interval} = [9, 8] \\
\text{Confidence interval} = [9, 8] \\
[54, 98] \text{ is wrong, use exact rather than the approximate} \\
\text{Hint: the confidence interval has the same length as the acceptance interval but is centered around } T_1. \\
\]

Conclusion: