Violence in television. See handout. [Hollander & Wolfe, “Nonparametric Statistical Analysis,” page 124.] Is there evidence to indicate that children who watched violent TV (The Karate Kid) take longer to seek help? Use a Wilcoxon Rank Sum test. (Additionally, find a 95% CI for the difference in mean amount of time for the violent TV watchers compared to the sports TV watchers.)

**Solution:**

X = number of seconds to get an adult for Karate Kid watchers
Y = number of seconds to get an adult for Olympics watchers

n=m=21, N=42, N(N+1)/2 = 903

\[ H_0 : \quad E(X) \geq E(Y) \]
\[ H_1 : \quad E(X) < E(Y) \]

\[ T = \sum_{i=1}^{n} R(X_i) = 395.5 \]
\[ \sum_{j=1}^{m} R(Y_j) = 507.5 \]

\[ Z = \frac{T - \frac{n(N+1)}{2}}{\sqrt{\frac{nm(N+1)}{12}}} \]
\[ = \frac{395.5 - \frac{21 \times 43}{2}}{\sqrt{\frac{21 \times 21 + 43}{12}}} \]
\[ = -1.4087 \]

\[ p-value \quad = \quad P(Z \leq -1.4087) = 0.08 \]

What if we want to consider the effect of ties?

\[ T_1 = \frac{T - \frac{n(N+1)}{2}}{\sqrt{\frac{nm}{N(N-1)} \sum_{i=1}^{N} R_i^2 - \frac{nm(N+1)^2}{4(N-1)}}} \]
\[ = -1.443 \]

\[ p-value \quad = \quad P(Z \leq -1.443) = 0.074 \]

Not very convincing evidence to say that Karate Kid produces less reactive child-care watchers.
• Witnessing violence data (Olympics versus Karate Kid on TV): \(n=21, N=42,\)

\[
\omega_{\alpha/2} = \frac{n(N+1)}{2} + z_{\alpha/2} \sqrt{\frac{nm(N+1)}{12}} = \frac{21 \cdot 43}{2} - 1.96 \sqrt{\frac{21 \cdot 21 \cdot 43}{12}} = 373.6
\]

\[
\omega_{1-\alpha/2} = \frac{21 \cdot 43}{2} + 1.96 \sqrt{\frac{21 \cdot 21 \cdot 43}{12}} = 529.4
\]

reject \(H_0\) if \(k < 373.6 - \frac{n(n+1)}{2} = 142.6\)

reject \(H_0\) if \(k > 529.4 - \frac{n(n+1)}{2} = 298.4\)

– Notice that 141st difference is -30min, 144th difference is -29min.
  If we add -30 to all \(Y_j\) \(\Rightarrow k = 140,\) don’t reject
  If we add -29 to all \(Y_j\) \(\Rightarrow k = 143,\) don’t reject
  If we add anything less than -30 (say, -30.5), we reject.

– Notice that 296th difference is 4min, 299th difference is 5min.
  If we add 4 to all \(Y_j\) \(\Rightarrow k = 298,\) don’t reject
  If we add 5 to all \(Y_j\) \(\Rightarrow k = 300,\) reject
  If we add anything bigger than 5 (say 4.5), we don’t reject.

A 95% CI for \(E(X) - E(Y)\) is: \([-30\text{min, } 5\text{min}]\)