

# Non-Parametric Tests

## Non-Parametric Test Equivalent to Paired t-Test or $\bar{X}$ -to- $\mu$

### Wilcoxon Signed Rank Test

- raw data as collected (data for single sample or difference for paired data)  
104, 79, 98, 150, 87, 136, 101
- sort from smallest-to-largest  
79, 87, 98, 101, 104, 136, 150
- subtract hypothesized true median (let's say 95); experimental median is 101  
-16, -8, 3, 6, 9, 41, 55
- sort from smallest-to-largest without considering sign  
3, 6, -8, 9, -16, 41, 55
- assign rank maintaining sign (ties take average rank)  
1, 2, -3, 4, -5, 6, 7
- sum up positive ranks and negative ranks (dropping sign)  
positive: 20  
negative: 8
- if true median is similar to experimental median then we expect the two ranks to be similar; a large difference in ranks suggests that the data is not consistent with the true median

## Non-Parametric Test Equivalent to Unpaired t-Test

### Wilcoxon Rank Sum Test

- raw data as collected  
sample 1: 9.8, 10.2, 10.7, 9.5, 10.5  
sample 2: 7.7, 9.7, 8.0, 9.9, 9.0
- sort data from smallest-to-largest, but maintain sample identity  
7.7, 8.0, 9.0, **9.5**, 9.7, **9.8**, 9.9, **10.2**, **10.5**, **10.7**
- assign rank, but maintain sample identity  
1, 2, 3, **4**, 5, **6**, 7, **8**, **9**, **10**
- sum up ranks by sample (ties take average rank)  
sample 1: 37  
sample 2: 18
- for each sample, subtract  $\frac{n_i(n_i+1)}{2}$  from each sum, where  $n_i$  is the size of the  $i^{th}$  sample  
sample 1:  $37 - \frac{5(5+1)}{2} = 37 - 15 = 22$   
sample 2:  $18 - \frac{5(5+1)}{2} = 18 - 15 = 3$
- if there is no difference between then we expect the two results to be similar; a large difference suggests that the samples are not similar to each other