

Use the following questions to check your understanding of the Wilcoxon Tests.

The various t Tests (from last week's material) are tests while the Wilcoxon Tests are non-
 tests. (Hint: use the same word for both entries.) This is because t Tests rely on t distributions to calculate the p-value while Wilcoxon tests use sums of ranks and mathematical counting techniques to calculate the p-value.

Create a dotplot in R by running the code:

```
ggplot(cars) +  
  geom_dotplot(aes(x=dist))
```

Confirm that you have correctly made this plot by recording the maximum value shown in the plot:

The distribution of this dot plot, while possibly normal, would probably be best classified as right-skewed. Run the following commands to see this for yourself.

```
> library(car)  
> qqPlot(cars$dist)
```

At roughly which normal quantile (norm quantile) does the data in the Q-Q Plot first go outside the dashed lines?

Recreate the dot plot in R.

```
ggplot(cars) +  
  geom_dotplot(aes(x=dist))
```

When data is skewed the is the best measure of center. So if we were to test a hypothesis about the center of this data, a hypothesis about the median would be very appropriate.

Write the name of the hypothesis test that would be most appropriate for testing the following hypotheses for the data shown in the dot plot in R:

Hypotheses:

$$H_0 : \text{median} = 100$$

$$H_a : \text{median} \neq 100$$

Add a vertical line to your dot plot in R to mark the value of the null hypothesis for the median with the code:

```
ggplot(cars) +  
  geom_dotplot(aes(x=dist)) +  
  geom_vline(xintercept=100)
```

Just looking at the plot, which conclusion seems most reasonable.

- ☒ Reject the null hypothesis. The median looks to be much less than 100.
- ☐ Fail to reject the null hypothesis. It seems reasonable that the median could be 100.

Conduct the hypothesis test in R with the code:

```
> wilcox.test(cars$dist, mu = 100, alternative = "two.sided")
```

What is the value of the test statistic?

What is the probability that the test statistic would be as extreme or more extreme than this value?

What conclusion does this probability give us?

- There is sufficient evidence to reject the null hypothesis (p-value less than the significance level). We will conclude that the
- ☒ population median is not equal to 100.
- There is insufficient evidence to reject the null hypothesis (p-value greater than the significance level). We will continue to
- ☐ assume that the population median is 100 like we originally hypothesized.