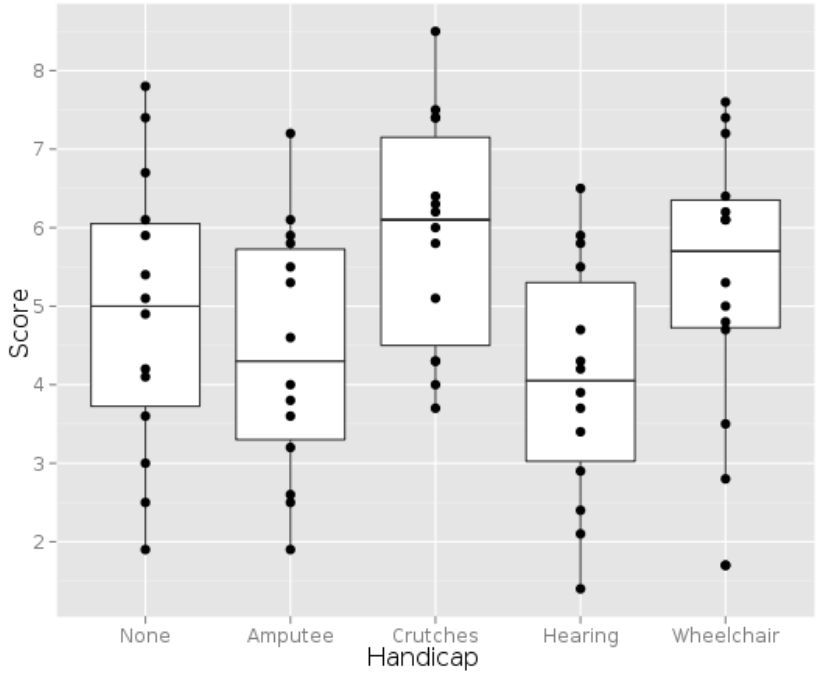
One way ANOVA worked example.
Discrimination Against the Physically Disabled Case Study 6.1 in Sleuth



Summary Statistics:

	None	Amputee	Crutches	Hearing	Wheelchair	Overall
Average	4.90	4.43	5.92	4.05	5.34	4.93
SD	1.79	1.59	1.48	1.53	1.75	1.72
Sample Size	14	14	14	14	14	70

We are going to perform a one-way analysis of variance to answer the question:
Do subjects evaluate qualifications differently according to the candidates handicap?

1. Read the study description in Sleuth 6.1.1. Are causal inferences possible? Are population inferences possible?

2. Fill in the blanks:

The null hypothesis is that all groups have the _____ _____.
The alternative hypothesis is that _____ one group has a different _____.

3. Fill in the blanks with a number:

In the reduced model we have to estimate _____ mean/s.
In the full model we have to estimate _____ mean/s.

4. What is the **full model residual** for the subject that gives the Amputee a score of 4.0?

5. What is the **reduced model residual** for the subject that gives the Amputee a score of 4.0?

6. Calculate the pooled standard deviation, and it's degrees of freedom.

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2 + \ldots (n_I - 1)s_I^2}{(n_1 - 1) + (n_2 - 1) + \ldots (n_I - 1)}}$$

6. Find the within group sum of squares and the total sum of squares using the shortcuts from homework 6.

Within group sum of squares = s_p^2 x (degrees of freedom for s_p)
=

Total sum of squares = (Overall SD)^2 x (n - 1)
=

8. Fill in the ANOVA table.

	Sum of squares	d.f	Mean Square	F-statistic	p-value
Between Groups					
Within Groups					
Total					

If the null hypothesis is true, the F-statistic will be distributed like a __-distribution with ___ and ___ degrees of freedom.

The p-value can be found in R with: `1 - pf( ________, _____, _____)`

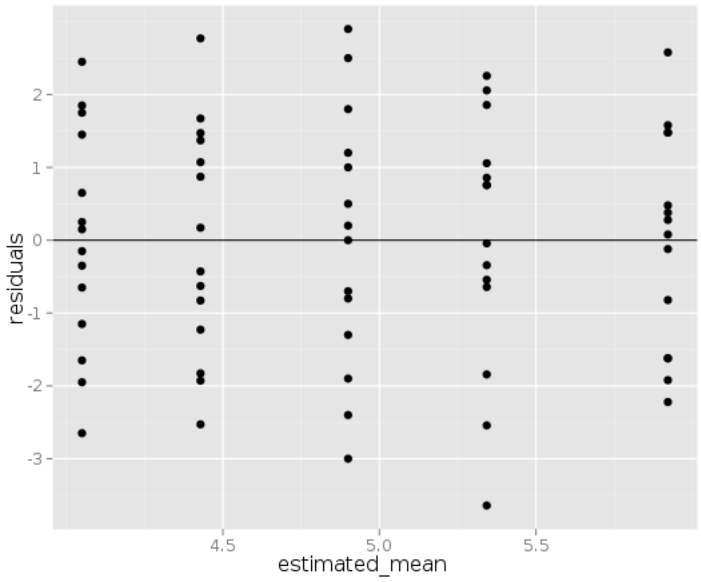
9. **Statistical summary**. Fill in the blanks:

There is _____ evidence that mean scores given to applicants with different disability status are _____ (F-test, p-value = _____).

10. What are the three assumptions of the one-way ANOVA?

1.
2.
3.

Which can you check by examining the plot below?



11. Imagine we want to compare candidates with crutches to those with no disability.
    a. The estimated difference in mean Score between a candidate with no disability and a candidate with crutches is:

    b. The standard error on the difference estimated in a. is:

$$\mathrm{SE}_{\overline{Y}_2-\overline{Y}_1} = s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}$$

    c. A 95% confidence interval for the difference in a. is:

(Hint: qt(0.975, 65) = 2.00)