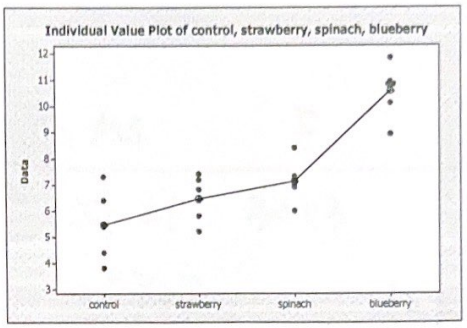
EXAMPLE: Blueberry and Aging – Rod Walking

https://www.jneurosci.org/content/19/18/8114

Real data: "elderly" rats are fed either a Regular Diet alone or supplemented with Strawberry powder, Spinach powder or Blueberry powder. Rats walk on a rod, and latency to fall (in seconds) is measured.

control	strawberry	spinach	blueberry
6.4	7.4	7.2	10.8
3.8	6.8	7.3	10.1
5.4	5.8	8.4	10.9
4.4	6.4	6.9	8.9
5.5	5.2	6.0	11.8
7.3	7.2	7.0	10.8



Identify:

- Response variable: latency to fall (in seconds)
- Experimental units: "elderly" rats
- Factor: Diet 1 Factor w/ 4 levels
- Treatments: Reg Strawberry Spinach Blue

Check Assumptions:

- SRS of "elderly rats" – rats in study randomly selected from population of lab rats
  – randomly assigned to diets.
- Normal distribution of response variable in population for each group.
  – Check NO major outliers in ~~diet~~ data – look OK ✡.
- Equal variances for all groups in population

  However, since equal sample sizes (group), not a problem

1.277 0.774

× 2

1.548 is larger than 1.277 ✡.

(DO NOT write $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$!)

Conduct ANOVA Test: Given MSE = 0.9727 and SST = 107.07

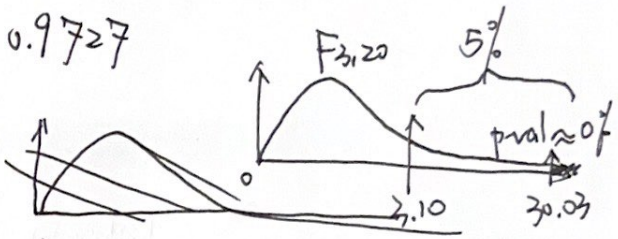
Hypotheses: H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$ H_a: Not all of the μ_i's are the same.

Test Statistic:

$g = 4$

$N = 24$

Source	df	SS	MS	F
Diet	3	87.62	29.21	30.03
Error	20	19.45	0.9727	
Total	~~23~~	107.07		



Decision: Rej H_0.

Conclusion: We have very strong evidence to say there is some differences in the average latency to fall for the different diets given.

Multiple Comparisons:

- Interpret the three procedures on the computer output
- Make Bonferroni Intervals using 94% Family Confidence

$\bar{y}_{i\cdot} - \bar{y}_{j\cdot} \pm t \cdot S_p \cdot \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}$

① $df_{error} = N - g = 20$

comp $= \frac{4 \times 3}{2} = 6$

lose total 6%

lose each one $\frac{6\%}{6} = 1\%$

- Individual CONF level: 99%

t-table. $t = 2.845$

Another way:

$t_{N-g,\, \alpha/g(g-1)} = t_{20,\, \frac{6\%}{4\times 3}} = t_{20,\, 0.005} = 2.845$

② $S_p = \sqrt{MSE} = \sqrt{0.9727} = 0.9863$

③ $n_i = n_j = 6$.

④ margin of error:

$t \cdot S_p \sqrt{\frac{1}{n_i} + \frac{1}{n_j}} = 2.845 \times 0.9863 \times \sqrt{\frac{1}{6} + \frac{1}{6}}$

$= 1.62$

⑤ Order means + connect those that are less than m.e. apart from each other.

Control 5.467

Straw 6.467

Spinach 7.133

Blue. 10.550

Same results as Tukey/Fisher but with different Family CONF. levels

Interpret the results of the Rotating Rod experiment – overall ANOVA test, the three Multiple Comparison Procedures in the output, and Bonferroni (do by hand at 94% Family Confidence).

Bonferroni: $t = t_{20, 0.005} = 2.845$

$S_p = \sqrt{1.217} = 1.103$

$\sqrt{\frac{1}{n_i} + \frac{1}{n_j}} = \sqrt{\frac{1}{6} + \frac{1}{6}} = 0.577$

$\Rightarrow$ m.e. $= 2.845 \times 1.103 \times 0.577 = 1.81$

Spinach	3.217	
Straw	3.617	
Control	3.903	
Blue	7.567	****