

Single factor ANOVA with three levels - unequal standard deviations

Names: (signatures only please, printed names will not be counted)

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| 1.) | 4.) |
| 2.) | 5.) |
| 3.) | 6.) |

In previous exercises we analyzed data using a single-factor ANOVA model with three levels.

Our model for the data generating process is:

$$y_{ij} = \alpha_j + e_{ij} \quad j = 1, 2, 3$$

This model assumes:

- The mean of y at level 1 is α_1
- The mean of y at level 2 is α_2
- The mean of y at level 3 is α_3

This is the "signal" part of y . The "noise" part, e_{ij} , was assumed to be an independently distributed normal random variable with mean zero and standard deviation σ_e .

Previously, we have assumed that this standard deviation is the same regardless of the level of the factor. Actually, this is a requirement for a classical or frequentist ANOVA.

No such assumption is required for the Bayesian equivalent, so we can allow each level to have a separate value for σ_e .

In this exercise, we will allow this by altering the Stan model file. In the parameters section, we will replace

```
real<lower=0> sigma;
```

with

```
real<lower=0> sigma[3];
```

We also have to modify the likelihood part of the model from

```
y[i] ~ normal(alpha[j],sigma);
```

to

```
y[i] ~ normal(alpha[j],sigma[j]);
```

The data for this exercise is in:

```
MTH225-6_IC2.csv
```

The Stan model file for this exercise can be patterned after:

```
single_factor_anova_three_levels_nh.stan
```

Questions

- 1) Which, if any, of the parameters α_1 , α_2 , and α_3 are significantly different?

- 2) Which, if any, of the parameters σ_1 , σ_2 , and σ_3 are significantly different?