1. toxeffect*ij*= µ + α*i* + π*j* + ϵ*ij*

toxeffect*ij* = degree of irritation of subject *j*, from chemical *i*.

*i*=1,2,3 *j*=1,2,3,4,5,6,7,8

µ = overall mean degree of irritation

α*i* = effect of chemical *i*

πj = random effect on *j*th rat

ϵ*ij* = random error of subject *j* when measured under *i*th chemical.

Assumptions:

* 1. πj’s are independent and normal with mean 0 and variance
  2. ϵij’s independent and normal with mean 0 and variance .
  3. πj’s are independent of ϵ*ij*’s

1. 

H0: The irritation level means are the same across all chemical treatments

Ha: The irritation level means are different for at least one of the chemical treatments

At the 0.05 significance level, there is no evidence to suggest that the irritation level means in rats are different across chemical treatments 1-3.

1. 

After ignoring within subject relationships and using a One-way ANOVA model, the null hypothesis is still not rejected, suggesting that there is no difference in level of irritation across chemical treatments 1-3. The effects of ignoring the within subject relationships in this case makes the effect more significant, but not enough to provide evidence that there are different irritation levels across chemical treatments 1-3.

1. 

The first assumption that the Variances are the same is not met. 1.6 is not similar to 2.1 or 4.3. The second assumption that the covariants are not similar to each other either. The compound symmetry assumption is not met.



Looing at the qnorm plot and the histogram of the residuals, I would say that the normality assumption is valid.

H0: Chemical Response distribution median for the different treatments is identical

Ha: At least two chemical response distributions differ in median

If Fr > X21-a(a-1), reject H0. With Degree of freedom = k-1 = 3-1 = 2. (> 5.99147)

|  |  |  |  |
| --- | --- | --- | --- |
| Rat | chem1 | chem2 | chem3 |
| 1 | 6 | 5 | 3 |
| 2 | 9 | 8 | 4 |
| 3 | 6 | 9 | 3 |
| 4 | 5 | 8 | 6 |
| 5 | 7 | 8 | 9 |
| 6 | 5 | 7 | 6 |
| 7 | 6 | 7 | 5 |
| 8 | 6 | 5 | 7 |

|  |  |  |  |
| --- | --- | --- | --- |
| Rank | chem1 | chem2 | chem3 |
|  | 1 | 2 | 3 |
|  | 1 | 2 | 3 |
|  | 2 | 1 | 3 |
|  | 3 | 1 | 2 |
|  | 3 | 2 | 1 |
|  | 3 | 1 | 2 |
|  | 2 | 1 | 3 |
|  | 2 | 3 | 1 |
| R | 17 | 13 | 18 |

= 1.75.

At the 0.05 significance level, there is no evidence to suggest that the chemical response distributions are different for at least two chemicals.

1. a
2. The advantages that Repeated Measures provide would be greater in humans than rats. Since there are probably more differences between humans than rats, being able to use RM would allow the researcher to exclude of individual differences.