

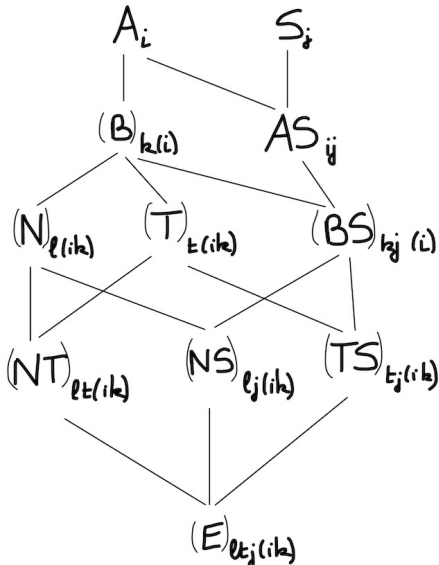
Stat 850, midterm exam: solution key

2019-04-01

- No. The non-centrality parameter is proportional to $bs/(8^2 + s \times 11^2)$, which is higher at 0.0326797 when $b=5$, $s=2$, and lower at 0.028103 when $b=4$, $s=3$.
- CRD with subsampling. $b=5$ birds at each dose, $s=2$ neurons per bird, from dfs in ANOVA table
 - $F = 0.258839 / 0.019296 = 13.41$ on dfs = 2 and 12: p-value < 0.01. Strong evidence that the neurons average precision differs between (at least 2) doses.
 - contrast $c = 0.5019 - 2 \times 0.7305 + 0.8123 = -0.1467$ with estimated variance $SE^2 = 0.01929 \times (1/10 + 4/10 + 1/10) = 0.01157$. t-value = $-0.1467 / \sqrt{0.01157} = -1.363$ on df=12. p-value: $\sim 2 \times 0.10$: The data are compatible with a *linear* dose effect.
- paired t-test: pairing by trial
 - split plot: EU for age is bird, which is crossed with song/silence. “age” is the whole-plot factor; “song/silence” is the subplot factor.
 - The data violate the constant variance assumption (not surprising for measurements that must be ≥ 0 but get close to 0). We should try a log or a square-root transformation, and later check residuals. The difference in variances is marked but not extreme, so try square-root first:

```
lmer( sqrt(firing_rate_average) ~ age + song + age:song + (1|bird), dat=dat_ave)
```

- ANOVA table with terms and dfs (Hasse diagram in case it helps)



source	df	R = random
A = age	1	
B = bird	18	R
S = song	1	
AS	1	
BS	18	R
N = neuron	40	R
T = trial	120	R
NT	240	R
NS	40	R
TS	120	R
E = NTS	240	R

- F tests for the interaction song and age: $F = MS_{\text{AgeSong}} / MS_{\text{BirdSong}}$ on dfs = 1 and 18.
(MS BirdSong = MS subplot error in (b))

Grade distribution (median=69.5):

90-94 : 1
 80-89 : 9
 70-79 : 7
 60-69 : 8
 50-59 : 2
 40-49 : 6
 0-39 : 1