Question for Peter

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## ANOVA

anova(fit.BA, type="3")

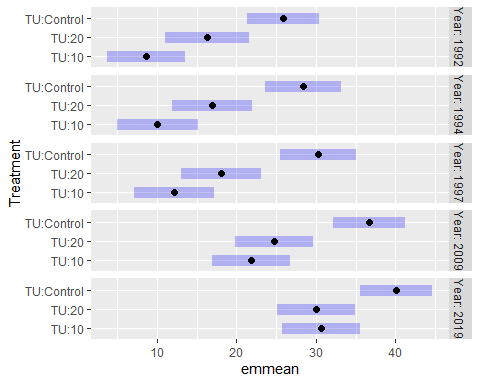
## Analysis of Variance Table  
## Df Sum Sq Mean Sq F value  
## Year 4 3489.1 872.28 94.6158  
## Treatment 2 277.3 138.63 15.0369  
## Year:Treatment 8 200.8 25.10 2.7227

## Generate cell means

# joint\_tests(fit.BA) #another way to see the ANOVA table for the overall tests  
  
cell.means <- emmeans(fit.BA, ~ Treatment\*Year)  
  
cell.means

## Treatment Year emmean SE df lower.CL upper.CL  
## TU:10 1992 8.65 2.38 24.9 3.73 13.6  
## TU:20 1992 16.29 2.58 32.3 11.04 21.5  
## TU:Control 1992 25.85 2.21 24.9 21.30 30.4  
## TU:10 1994 10.04 2.47 27.9 4.99 15.1  
## TU:20 1994 16.91 2.47 27.9 11.85 22.0  
## TU:Control 1994 28.36 2.36 31.0 23.55 33.2  
## TU:10 1997 12.15 2.47 27.9 7.10 17.2  
## TU:20 1997 18.02 2.47 27.9 12.97 23.1  
## TU:Control 1997 30.23 2.36 31.0 25.42 35.0  
## TU:10 2009 21.83 2.38 24.9 16.92 26.7  
## TU:20 2009 24.73 2.38 24.9 19.81 29.6  
## TU:Control 2009 36.65 2.21 24.9 32.11 41.2  
## TU:10 2019 30.69 2.38 24.9 25.78 35.6  
## TU:20 2019 29.95 2.38 24.9 25.04 34.9  
## TU:Control 2019 40.10 2.21 24.9 35.55 44.6  
##   
## Degrees-of-freedom method: kenward-roger   
## Confidence level used: 0.95

plot(cell.means, by="Year")



## Contrasts

This is the code with interaction=“consec”.

year.by.trt <- contrast(cell.means, interaction = "consec", by = NULL) #might need to change the by = option here.

Need a slight change in code so that all treatments are contrasted. Right now it’s only contrasting consecutive treatments. Let’s change the interaction to “pairwise”:

year.by.trt <- contrast(cell.means,interaction="pairwise") #might need to change the   
  
year.by.trt

## Treatment\_pairwise Year\_pairwise estimate SE df t.ratio p.value  
## TU:10 - TU:20 1992 - 1994 -0.784 2.83 54.8 -0.276 0.7833   
## TU:10 - TU:Control 1992 - 1994 1.113 2.61 54.5 0.427 0.6712   
## TU:20 - TU:Control 1992 - 1994 1.896 2.81 54.9 0.675 0.5022   
## TU:10 - TU:20 1992 - 1997 -1.777 2.83 54.8 -0.627 0.5333   
## TU:10 - TU:Control 1992 - 1997 0.874 2.61 54.5 0.335 0.7387   
## TU:20 - TU:Control 1992 - 1997 2.651 2.81 54.9 0.944 0.3492   
## TU:10 - TU:20 1992 - 2009 -4.747 2.67 54.3 -1.780 0.0806   
## TU:10 - TU:Control 1992 - 2009 -2.374 2.39 54.0 -0.994 0.3247   
## TU:20 - TU:Control 1992 - 2009 2.373 2.58 54.3 0.919 0.3623   
## TU:10 - TU:20 1992 - 2019 -8.385 2.67 54.3 -3.145 0.0027   
## TU:10 - TU:Control 1992 - 2019 -7.794 2.39 54.0 -3.263 0.0019   
## TU:20 - TU:Control 1992 - 2019 0.591 2.58 54.3 0.229 0.8199   
## TU:10 - TU:20 1994 - 1997 -0.993 2.72 54.0 -0.366 0.7159   
## TU:10 - TU:Control 1994 - 1997 -0.239 2.72 54.0 -0.088 0.9303   
## TU:20 - TU:Control 1994 - 1997 0.755 2.72 54.0 0.278 0.7821   
## TU:10 - TU:20 1994 - 2009 -3.964 2.64 54.4 -1.503 0.1386   
## TU:10 - TU:Control 1994 - 2009 -3.487 2.61 54.5 -1.338 0.1866   
## TU:20 - TU:Control 1994 - 2009 0.476 2.61 54.5 0.183 0.8557   
## TU:10 - TU:20 1994 - 2019 -7.601 2.64 54.4 -2.883 0.0056   
## TU:10 - TU:Control 1994 - 2019 -8.907 2.61 54.5 -3.416 0.0012   
## TU:20 - TU:Control 1994 - 2019 -1.306 2.61 54.5 -0.501 0.6186   
## TU:10 - TU:20 1997 - 2009 -2.970 2.64 54.4 -1.126 0.2650   
## TU:10 - TU:Control 1997 - 2009 -3.249 2.61 54.5 -1.246 0.2181   
## TU:20 - TU:Control 1997 - 2009 -0.278 2.61 54.5 -0.107 0.9154   
## TU:10 - TU:20 1997 - 2019 -6.608 2.64 54.4 -2.506 0.0152   
## TU:10 - TU:Control 1997 - 2019 -8.668 2.61 54.5 -3.325 0.0016   
## TU:20 - TU:Control 1997 - 2019 -2.061 2.61 54.5 -0.790 0.4329   
## TU:10 - TU:20 2009 - 2019 -3.638 2.48 54.0 -1.467 0.1481   
## TU:10 - TU:Control 2009 - 2019 -5.420 2.39 54.0 -2.269 0.0273   
## TU:20 - TU:Control 2009 - 2019 -1.782 2.39 54.0 -0.746 0.4589   
##   
## Degrees-of-freedom method: kenward-roger

## Test

test(year.by.trt, joint=TRUE)

## df1 df2 F.ratio p.value note  
## 8 54.33 2.72 0.0135 d   
##   
## d: df1 reduced due to linear dependence