proj2

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```
library(AlgDesign)
desFull <- gen.factorial( levels=c(3,3,2,2), nVars=4, varNames=c("attr1","attr2","feat1","feat2"), cent
print(desFull)
```

```
##    attr1 attr2 feat1 feat2
## 1      1     1     1     1
## 2      2     1     1     1
## 3      3     1     1     1
## 4      1     2     1     1
## 5      2     2     1     1
## 6      3     2     1     1
## 7      1     3     1     1
## 8      2     3     1     1
## 9      3     3     1     1
## 10     1     1     2     1
## 11     2     1     2     1
## 12     3     1     2     1
## 13     1     2     2     1
## 14     2     2     2     1
## 15     3     2     2     1
## 16     1     3     2     1
## 17     2     3     2     1
## 18     3     3     2     1
## 19     1     1     1     2
## 20     2     1     1     2
## 21     3     1     1     2
## 22     1     2     1     2
## 23     2     2     1     2
## 24     3     2     1     2
## 25     1     3     1     2
## 26     2     3     1     2
## 27     3     3     1     2
## 28     1     1     2     2
## 29     2     1     2     2
## 30     3     1     2     2
## 31     1     2     2     2
## 32     2     2     2     2
## 33     3     2     2     2
## 34     1     3     2     2
## 35     2     3     2     2
## 36     3     3     2     2
```

```
fml = ~ factor(attr1) + factor(attr2) + factor(feat1) + factor(feat2)
desDummies = model.matrix(fml, data=desFull)
colnames(desDummies) = paste0("D",(1:dim(desDummies)[2]))
print(desDummies)
```

```
##    D1 D2 D3 D4 D5 D6 D7
## 1   1  0  0  0  0  0  0
## 2   1  1  0  0  0  0  0
## 3   1  0  1  0  0  0  0
## 4   1  0  0  1  0  0  0
## 5   1  1  0  1  0  0  0
## 6   1  0  1  1  0  0  0
## 7   1  0  0  0  1  0  0
## 8   1  1  0  0  1  0  0
## 9   1  0  1  0  1  0  0
## 10  1  0  0  0  0  1  0
## 11  1  1  0  0  0  1  0
## 12  1  0  1  0  0  1  0
## 13  1  0  0  1  0  1  0
## 14  1  1  0  1  0  1  0
## 15  1  0  1  1  0  1  0
## 16  1  0  0  0  1  1  0
## 17  1  1  0  0  1  1  0
## 18  1  0  1  0  1  1  0
## 19  1  0  0  0  0  0  1
## 20  1  1  0  0  0  0  1
## 21  1  0  1  0  0  0  1
## 22  1  0  0  1  0  0  1
## 23  1  1  0  1  0  0  1
## 24  1  0  1  1  0  0  1
## 25  1  0  0  0  1  0  1
## 26  1  1  0  0  1  0  1
## 27  1  0  1  0  1  0  1
## 28  1  0  0  0  0  1  1
## 29  1  1  0  0  0  1  1
## 30  1  0  1  0  0  1  1
## 31  1  0  0  1  0  1  1
## 32  1  1  0  1  0  1  1
## 33  1  0  1  1  0  1  1
## 34  1  0  0  0  1  1  1
## 35  1  1  0  0  1  1  1
## 36  1  0  1  0  1  1  1
## attr(,"assign")
## [1] 0 1 1 2 2 3 4
## attr(,"contrasts")
## attr(,"contrasts")$`factor(attr1)`
## [1] "contr.treatment"
##
## attr(,"contrasts")$`factor(attr2)`
## [1] "contr.treatment"
##
## attr(,"contrasts")$`factor(feat1)`
## [1] "contr.treatment"
##
## attr(,"contrasts")$`factor(feat2)`
## [1] "contr.treatment"
```

```
desFract = optFederov(~ . -1,data=desDummies,nTrials=12)
print(desFract)
```

```
## $D
## [1] 0.2576402
##
## $A
## [1] 5.914286
##
## $Ge
## [1] 0.897
##
## $Dea
## [1] 0.892
##
## $design
##    D1 D2 D3 D4 D5 D6 D7
## 3   1  0  1  0  0  0  0
## 5   1  1  0  1  0  0  0
## 7   1  0  0  0  1  0  0
## 11  1  1  0  0  0  1  0
## 15  1  0  1  1  0  1  0
## 16  1  0  0  0  1  1  0
## 19  1  0  0  0  0  0  1
## 23  1  1  0  1  0  0  1
## 27  1  0  1  0  1  0  1
## 30  1  0  1  0  0  1  1
## 31  1  0  0  1  0  1  1
## 35  1  1  0  0  1  1  1
##
## $rows
##  [1]  3  5  7 11 15 16 19 23 27 30 31 35
```

```
eval.design(~.-1, desFract$design)
```

```
## $determinant
## [1] 0.2576402
##
## $A
## [1] 5.914286
##
## $diagonality
## [1] 0.588
##
## $gmean.variances
## [1] 5.756168
```

```
#Check dummies for model with just main effects
desD1 = model.matrix(~factor(attr1) + factor(attr2), data=desFull)
print(desD1)
```

```
##    (Intercept) factor(attr1)2 factor(attr1)3 factor(attr2)2 factor(attr2)3
## 1            1              0              0              0              0
## 2            1              1              0              0              0
## 3            1              0              1              0              0
## 4            1              0              0              1              0
```

```
## 5            1              1              0              1              0
## 6            1              0              1              1              0
## 7            1              0              0              0              1
## 8            1              1              0              0              1
## 9            1              0              1              0              1
## 10           1              0              0              0              0
## 11           1              1              0              0              0
## 12           1              0              1              0              0
## 13           1              0              0              1              0
## 14           1              1              0              1              0
## 15           1              0              1              1              0
## 16           1              0              0              0              1
## 17           1              1              0              0              1
## 18           1              0              1              0              1
## 19           1              0              0              0              0
## 20           1              1              0              0              0
## 21           1              0              1              0              0
## 22           1              0              0              1              0
## 23           1              1              0              1              0
## 24           1              0              1              1              0
## 25           1              0              0              0              1
## 26           1              1              0              0              1
## 27           1              0              1              0              1
## 28           1              0              0              0              0
## 29           1              1              0              0              0
## 30           1              0              1              0              0
## 31           1              0              0              1              0
## 32           1              1              0              1              0
## 33           1              0              1              1              0
## 34           1              0              0              0              1
## 35           1              1              0              0              1
## 36           1              0              1              0              1
## attr(,"assign")
## [1] 0 1 1 2 2
## attr(,"contrasts")
## attr(,"contrasts")$`factor(attr1)`
## [1] "contr.treatment"
##
## attr(,"contrasts")$`factor(attr2)`
## [1] "contr.treatment"
```

```
y = desD1*c(1,.2,.3,.4)+rnorm(6,sd=.1)
res1a = lm(y~factor(attr1) + factor(attr2), data=desFull)
print(summary(res1a))
```

```
## Response (Intercept) :
##
## Call:
## lm(formula = `(Intercept)` ~ factor(attr1) + factor(attr2), data = desFull)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.3134 -0.2211 -0.0769  0.1442  0.4671
##
```

```
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     4.726e-01  1.084e-01   4.361 0.000133 ***
## factor(attr1)2  2.226e-02  1.187e-01   0.188 0.852444
## factor(attr1)3 -1.425e-03  1.187e-01  -0.012 0.990501
## factor(attr2)2  3.738e-17  1.187e-01   0.000 1.000000
## factor(attr2)3  4.532e-17  1.187e-01   0.000 1.000000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2908 on 31 degrees of freedom
## Multiple R-squared:  0.001613,   Adjusted R-squared:  -0.1272
## F-statistic: 0.01252 on 4 and 31 DF,  p-value: 0.9997
##
##
## Response factor(attr1)2 :
##
## Call:
## lm(formula = `factor(attr1)2` ~ factor(attr1) + factor(attr2),
##     data = desFull)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.23286 -0.13835 -0.06223  0.11508  0.46714
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.399e-03  7.712e-02  -0.031    0.975
## factor(attr1)2  4.973e-01  8.448e-02   5.886  1.7e-06 ***
## factor(attr1)3 -1.425e-03  8.448e-02  -0.017    0.987
## factor(attr2)2  5.701e-17  8.448e-02   0.000    1.000
## factor(attr2)3  4.532e-17  8.448e-02   0.000    1.000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2069 on 31 degrees of freedom
## Multiple R-squared:  0.5991, Adjusted R-squared:  0.5474
## F-statistic: 11.58 on 4 and 31 DF,  p-value: 7.235e-06
##
##
## Response factor(attr1)3 :
##
## Call:
## lm(formula = `factor(attr1)3` ~ factor(attr1) + factor(attr2),
##     data = desFull)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.31335 -0.10732  0.00000  0.07434  0.38665
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.399e-03  6.658e-02  -0.036    0.971
## factor(attr1)2  2.226e-02  7.294e-02   0.305    0.762
```

```
## factor(attr1)3  4.736e-01  7.294e-02   6.493 3.04e-07 ***
## factor(attr2)2  1.831e-17  7.294e-02   0.000    1.000
## factor(attr2)3  1.700e-17  7.294e-02   0.000    1.000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1787 on 31 degrees of freedom
## Multiple R-squared:  0.634,  Adjusted R-squared:  0.5867
## F-statistic: 13.42 on 4 and 31 DF,  p-value: 1.858e-06
##
##
## Response factor(attr2)2 :
##
## Call:
## lm(formula = `factor(attr2)2` ~ factor(attr1) + factor(attr2),
##     data = desFull)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.3134 -0.1371 -0.0375  0.1073  0.4671
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.399e-03  7.164e-02  -0.033    0.974
## factor(attr1)2  2.226e-02  7.848e-02   0.284    0.779
## factor(attr1)3 -1.425e-03  7.848e-02  -0.018    0.986
## factor(attr2)2  4.750e-01  7.848e-02   6.052 1.06e-06 ***
## factor(attr2)3  2.266e-17  7.848e-02   0.000    1.000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1922 on 31 degrees of freedom
## Multiple R-squared:  0.6123, Adjusted R-squared:  0.5623
## F-statistic: 12.24 on 4 and 31 DF,  p-value: 4.392e-06
##
##
## Response factor(attr2)3 :
##
## Call:
## lm(formula = `factor(attr2)3` ~ factor(attr1) + factor(attr2),
##     data = desFull)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.3134 -0.1371 -0.0375  0.1073  0.4671
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.399e-03  7.164e-02  -0.033    0.974
## factor(attr1)2  2.226e-02  7.848e-02   0.284    0.779
## factor(attr1)3 -1.425e-03  7.848e-02  -0.018    0.986
## factor(attr2)2  3.925e-17  7.848e-02   0.000    1.000
## factor(attr2)3  4.750e-01  7.848e-02   6.052 1.06e-06 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1922 on 31 degrees of freedom
## Multiple R-squared:  0.6123, Adjusted R-squared:  0.5623
## F-statistic: 12.24 on 4 and 31 DF,  p-value: 4.392e-06
```

```
# Now draw randomly a "half" random fractional factorial design
sampl = sample.int(n=6,size=3,replace=TRUE)
desHalf = desFull[sampl,]
print(desHalf)
```

```
##   attr1 attr2 feat1 feat2
## 4     1     2     1     1
## 5     2     2     1     1
## 3     3     1     1     1
```

```
res1b=lm(y[sampl]~factor(attr1)+factor(attr2), data=desHalf)
print(summary(res1b))
```

```
##
## Call:
## lm(formula = y[sampl] ~ factor(attr1) + factor(attr2), data = desHalf)
##
## Residuals:
## ALL 3 residuals are 0: no residual degrees of freedom!
##
## Coefficients: (1 not defined because of singularities)
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.5049         NA      NA       NA
## factor(attr1)2   0.4571         NA      NA       NA
## factor(attr1)3  -0.3471         NA      NA       NA
## factor(attr2)2       NA         NA      NA       NA
##
## Residual standard error: NaN on 0 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:    NaN
## F-statistic:   NaN on 2 and 0 DF,  p-value: NA
```

```
# Now take a random draw of conditions, still 6 observations, but some conditions will be double counte
sampl = sample.int(n=6,size=6,replace=TRUE)
desRandom = desFull[sampl,]
print(desRandom)
```

```
##     attr1 attr2 feat1 feat2
## 3       3     1     1     1
## 1       1     1     1     1
## 4       1     2     1     1
## 1.1     1     1     1     1
## 3.1     3     1     1     1
## 2       2     1     1     1
```

```r
# compute some optimal fractional factorial designs
formulaMainEffects1 = ~ attr1 + attr2 + feat1 +feat2
desConjointFract1 = AlgDesign::optFederov(formulaMainEffects1, data=desFull, nTrials=24)
eval.design(formulaMainEffects1,desConjointFract1$design)
```

```
## $determinant
## [1] 0.5339536
##
## $A
## [1] 7.8
##
## $diagonality
## [1] 0.304
##
## $gmean.variances
## [1] 2.19089
```

```r
# now with interaction between feat1 and feat2
formulaIntEffects2 = ~ attr1 + attr2 + feat1 + feat2 + feat1*feat2
desConjointFract2<- optFederov(formulaIntEffects2,data=desFull,nTrials=24)
print(desConjointFract2)
```

```
## $D
## [1] 0.3734504
##
## $A
## [1] 34.66667
##
## $Ge
## [1] 0.937
##
## $Dea
## [1] 0.936
##
## $design
##    attr1 attr2 feat1 feat2
## 1      1     1     1     1
## 3      3     1     1     1
## 4      1     2     1     1
## 6      3     2     1     1
## 7      1     3     1     1
## 9      3     3     1     1
## 10     1     1     2     1
## 11     2     1     2     1
## 12     3     1     2     1
## 16     1     3     2     1
## 17     2     3     2     1
## 18     3     3     2     1
## 19     1     1     1     2
## 21     3     1     1     2
## 22     1     2     1     2
## 24     3     2     1     2
## 25     1     3     1     2
```

```
## 27     3     3     1     2
## 28     1     1     2     2
## 29     2     1     2     2
## 30     3     1     2     2
## 34     1     3     2     2
## 35     2     3     2     2
## 36     3     3     2     2
##
## $rows
##  [1]  1  3  4  6  7  9 10 11 12 16 17 18 19 21 22 24 25 27 28 29 30 34 35
## [24] 36
```

```
eval.design(formulaIntEffects2,desConjointFract2$design)
```

```
## $determinant
## [1] 0.3734504
##
## $A
## [1] 34.66667
##
## $diagonality
## [1] 0.201
##
## $gmean.variances
## [1] 8.19069
```