# Lab4

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# Question 1

Making the dataset

```
library(tidyverse)
instruction <- c(rep("lecture", 5), rep("lab", 5), rep("discussion", 5))
scores <- c(5, 6, 7, 8, 9, 8, 8, 9, 10, 10, 4, 4, 5, 5, 6)
dat <- data.frame(instruction, scores) %>% mutate(instruction.numeric = as.numeric(instruction))
```

# Analysis

```
t.test(dat$scores[1:10]~dat$instruction[1:10])
```

```
## 
##  Welch Two Sample t-test
## 
## data:  dat$scores[1:10] by dat$instruction[1:10]
## t = 2.3905, df = 6.7586, p-value = 0.04938
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.007199513 3.992800487
## sample estimates:
##     mean in group lab mean in group lecture 
##                     9                     7
```

```
aov.mod <- aov(scores~instruction,dat)
summary(aov.mod)
```

```
##             Df Sum Sq Mean Sq F value   Pr(>F)    
## instruction  2  44.13   22.07   15.76 0.000439 ***
## Residuals   12  16.80    1.40                     
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

# effect sizes

```
library(lsr)
library(psych)
cohensD(dat$scores[1:10] ~ droplevels(dat$instruction[1:10]))
```

```
## [1] 1.511858
```

```
etaSquared(aov.mod)
```

```
##                eta.sq eta.sq.part
## instruction 0.7242888   0.7242888
```

```
tapply(dat$scores, dat$instruction, describe)
```

```
## $discussion
##    vars n mean   sd median trimmed  mad min max range skew kurtosis   se
## X1    1 5  4.8 0.84      5     4.8 1.48   4   6     2 0.25    -1.82 0.37
## 
## $lab
##    vars n mean sd median trimmed  mad min max range skew kurtosis   se
## X1    1 5    9  1      9       9 1.48   8  10     2    0     -2.2 0.45
## 
## $lecture
##    vars n mean   sd median trimmed  mad min max range skew kurtosis   se
## X1    1 5    7 1.58      7       7 1.48   5   9     4    0    -1.91 0.71
```

# doing regressiosn the wrong ways utilizing `as.numeric`

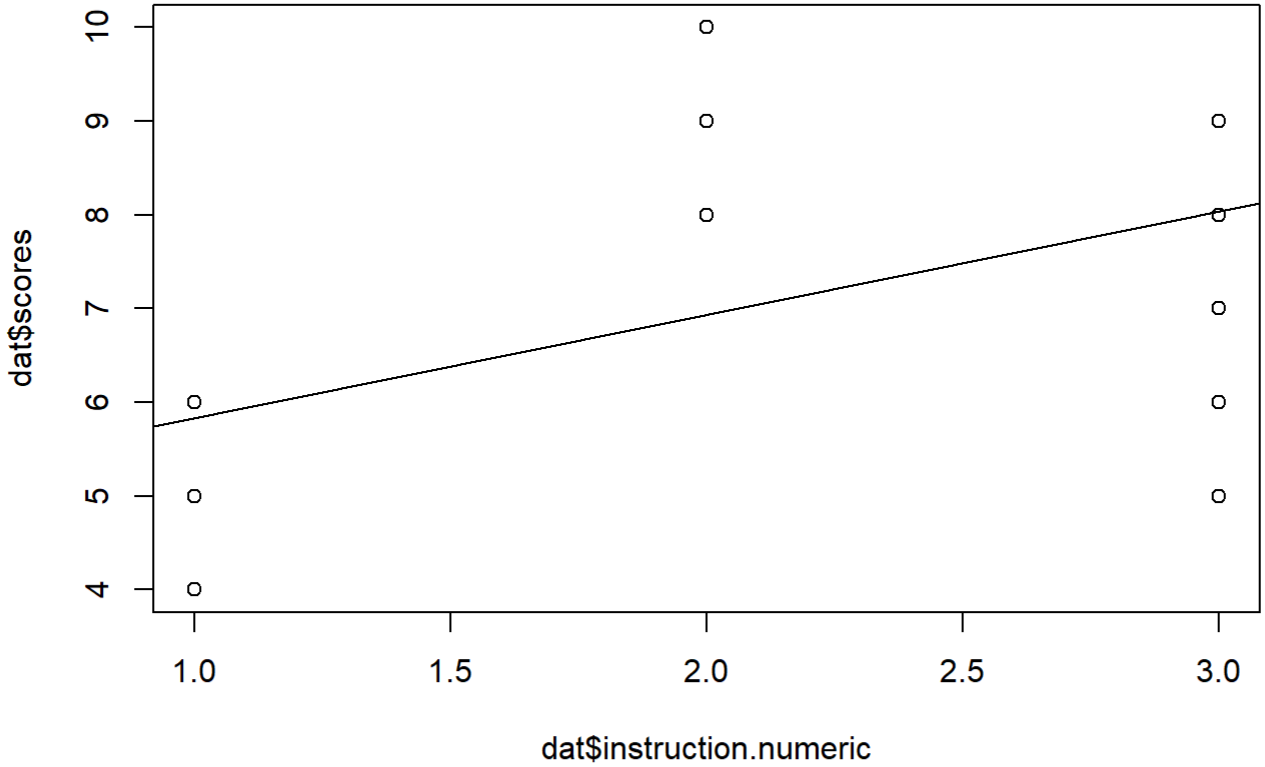
```
wrong <- lm(scores ~ instruction.numeric, dat)
summary(wrong)
```

```
## 
## Call:
## lm(formula = scores ~ instruction.numeric, data = dat)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max 
## -3.03333 -1.43333 -0.03333  1.06667  3.06667 
## 
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)   
## (Intercept)           4.7333     1.3240   3.575  0.00339 **
## instruction.numeric   1.1000     0.6129   1.795  0.09597 . 
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 1.938 on 13 degrees of freedom
## Multiple R-squared:  0.1986, Adjusted R-squared:  0.1369 
## F-statistic: 3.221 on 1 and 13 DF,  p-value: 0.09597
```

```
anova(wrong)
```

```
## Analysis of Variance Table
## 
## Response: scores
##                     Df Sum Sq Mean Sq F value  Pr(>F)  
## instruction.numeric  1 12.100 12.1000  3.2212 0.09597 .
## Residuals           13 48.833  3.7564                  
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(dat$instruction.numeric, dat$scores)
abline(wrong)
```



#now

doing it the right way.

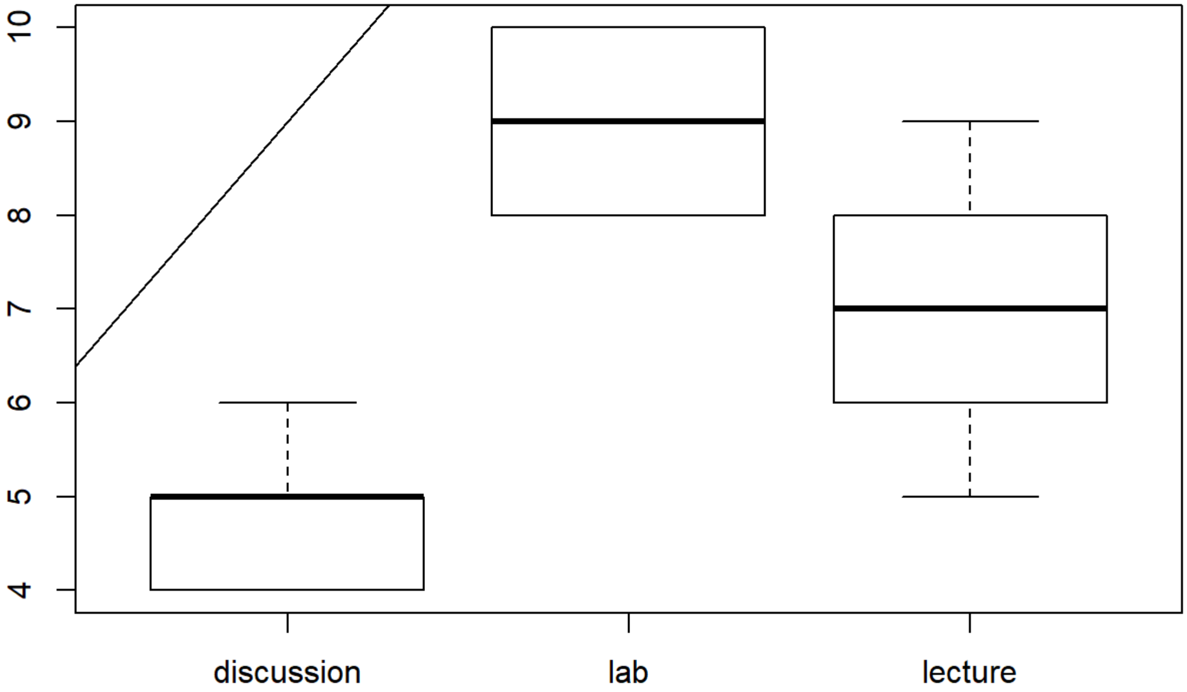
```
right <- lm(scores ~ instruction, dat)
summary(right)
```

```
## 
## Call:
## lm(formula = scores ~ instruction, data = dat)
## 
## Residuals:
##    Min     1Q Median     3Q    Max 
##   -2.0   -0.9    0.0    1.0    2.0 
## 
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)    
## (Intercept)           4.8000     0.5292   9.071 1.02e-06 ***
## instructionlab        4.2000     0.7483   5.612 0.000114 ***
## instructionlecture   2.2000     0.7483   2.940 0.012375 *  
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 1.183 on 12 degrees of freedom
## Multiple R-squared:  0.7243, Adjusted R-squared:  0.6783 
## F-statistic: 15.76 on 2 and 12 DF,  p-value: 0.0004393
```

```
anova(right)
```

```
## Analysis of Variance Table
## 
## Response: scores
##             Df Sum Sq Mean Sq F value    Pr(>F)    
## instruction  2 44.133  22.067  15.762 0.0004393 ***
## Residuals   12 16.800   1.400                      
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(dat$instruction, dat$scores)
abline(right)
```



#loading some data

```
load("~/GitHub/Regression/hand4.RData")
library(Amelia)
library(Zelig)
library(mice)
```

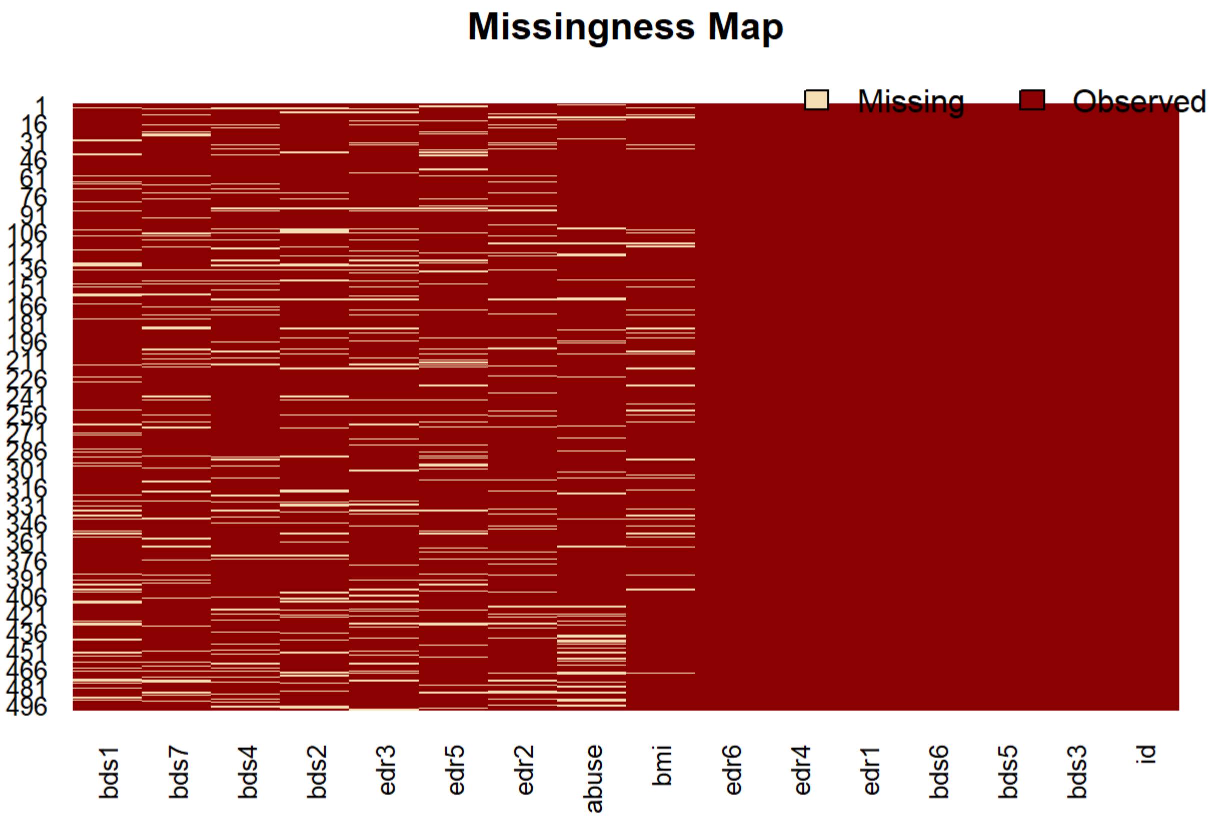
Imputing data via `Amelia`

```
mi <- amelia(hand4, m = 20)
```

```
## -- Imputation 1 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 2 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 3 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 4 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 5 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 6 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 7 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 8 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 9 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 10 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 11 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 12 --
##
##   1  2  3  4  5  6  7  8  9 10
##
## -- Imputation 13 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 14 --
```

```
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 15 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 16 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 17 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 18 --
##
##   1  2  3  4  5  6  7  8  9
##
## -- Imputation 19 --
##
##   1  2  3  4  5  6  7  8
##
## -- Imputation 20 --
##
##   1  2  3  4  5  6  7  8
```

```
missmap(mi)
```



```
for(i in 1:20) {

mi$imputations[[i]]$bds <- mi$imputations[[i]]$bds1 + mi$imputations[[i]]$bds2 + mi$imputations
[[i]]$bds3 + mi$imputations[[i]]$bds4 + mi$imputations[[i]]$bds5 + mi$imputations[[i]]$bds6 + mi
$imputations[[i]]$bds7


mi$imputations[[i]]$edr <- mi$imputations[[i]]$edr1 + mi$imputations[[i]]$edr2 + mi$imputations
[[i]]$edr3 + mi$imputations[[i]]$edr4 + mi$imputations[[i]]$edr5 + mi$imputations[[i]]$edr6
}
z.out <-zelig(edr~bds+abuse+bmi, model = "ls", data = mi)
```

```
## How to cite this model in Zelig:
##   R Core Team. 2007.
##   ls: Least Squares Regression for Continuous Dependent Variables
##   in Christine Choirat, Christopher Gandrud, James Honaker, Kosuke Imai, Gary King, and Olivi
a Lau,
##   "Zelig: Everyone's Statistical Software," http://zeligproject.org/
```

```
summary(z.out)
```

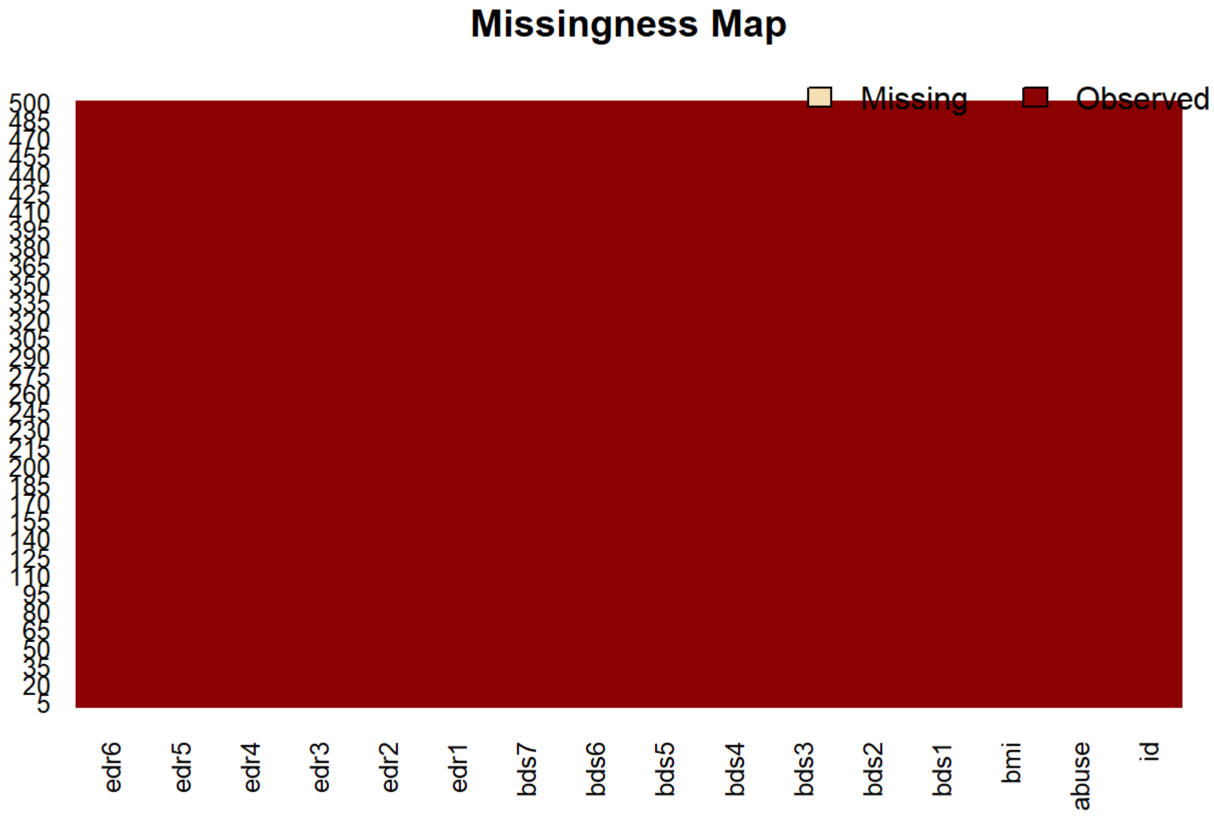
```
## Model: Combined Imputations
##
##              Estimate Std.Error z value Pr(>|z|)
## (Intercept)   8.9049    1.3622    6.54  6.3e-11
## bds           0.4811    0.0342   14.07  < 2e-16
## abuse         1.8451    0.5726    3.22   0.0013
## bmi           0.0760    0.0634    1.20   0.2307
##
## For results from individual imputed datasets, use summary(x, subset = i:j)
## Next step: Use 'setx' method
```

Imputing data via `mice`

```
imputed <- hand4 %>% mice(m = 20, maxit = 10, method = "pmm", seed = 69) %>%
    complete()
```

```
## 
##  iter imp variable
##   1   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   1   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   2   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   3   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   4   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   5   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   6   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   7   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   8   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   9   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   1  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   2  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   3  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   4  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   5  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   6  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   7  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   8  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   9  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   10  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   11  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   12  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   13  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   14  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   15  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   16  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   17  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   18  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   19  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
##   10   20  abuse  bmi  bds1  bds2  bds4  bds7  edr2  edr3  edr5
```

```
missmap(imputed)
```



look at that, much better.

```
imputed <- imputed %>%
  mutate(bds = (bds1 + bds2 +bds3 +bds4 +bds5 +bds6 +bds7)/7,
         edr = (edr1 + edr2 + edr3 +edr4 +edr5 +edr6))
miss.out <- lm(edr~bds+abuse+bmi,imputed)
summary(miss.out)
```

```
##
## Call:
## lm(formula = edr ~ bds + abuse + bmi, data = imputed)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10.6598  -2.3515  -0.1587   2.1311  11.7145
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.60137    1.32187   6.507 1.88e-10 ***
## bds          3.35927    0.22874  14.686  < 2e-16 ***
## abuse        1.65941    0.49436   3.357 0.000849 ***
## bmi          0.08948    0.06082   1.471 0.141863
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.485 on 496 degrees of freedom
## Multiple R-squared:   0.42,  Adjusted R-squared:  0.4165
## F-statistic: 119.7 on 3 and 496 DF,  p-value: < 2.2e-16
```

# how about some power?

```
load("~/GitHub/Regression/lab3.RData")
cor.dat <- cor(lab3)
round(cor.dat,2)
```

```
##         subjno timedrs phyheal menheal stress
## subjno    1.00    0.02    0.00   -0.07  -0.06
## timedrs   0.02    1.00    0.44    0.26   0.29
## phyheal   0.00    0.44    1.00    0.50   0.31
## menheal  -0.07    0.26    0.50    1.00   0.37
## stress   -0.06    0.29    0.31    0.37   1.00
```

```
require(MASS)
```

```
## Loading required package: MASS
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
pwr.MRC<-function(ry1=NULL, ry2=NULL, ry3=NULL, r12=NULL, r13=NULL, r23=NULL,n=NULL, alpha=.05,
 rep = 10000,
                        my=0,m1=0,m2=0,m3=0, sy=1,s1=1,s2=1,s3=1)
  {

pred<-NA
pred[is.null(r23)]<-2
pred[!is.null(r23)]<-3

  if (pred=="2")
    {pop <- mvrnorm(n, mu = c(my, m1, m2), Sigma = matrix(c(sy, ry1, ry2,
                                                                     ry1, s1, r12,
                                                                     ry2, r12, s2),
                                                                   ncol = 3), empirical = TRUE)
    pop2 = data.frame(pop)

    values<-lm(X1~X2+X3, pop2)
    values<-summary(values)

    int<-(values$coefficients)[1,3]
    tb1<-(values$coefficients)[2,3] #grabs t from each analysis
    tb2<-(values$coefficients)[3,3]
    R2<-values$r.squared
    F<-values$fstatistic[1]
    df1<-values$fstatistic[2]
    df2<-values$fstatistic[3]

    f2<-R2/(1-R2)
    lambdaR2<-f2*df2
    minusalpha<-1-alpha
    FtR2<-qf(minusalpha, df1, df2)
    powerR2<-round(1-pf(FtR2, df1,df2,lambdaR2),3)

    lambdab1<-tb1^2
    lambdab2<-tb2^2
    Fb<-qf(minusalpha, 1, df2)
    powerb1<-round(1-pf(Fb, 1,df2,lambdab1),3)
    powerb2<-round(1-pf(Fb, 1,df2,lambdab2),3)

    {print(paste("Sample size is ",n))}
    {print(paste("Power R2 = ", powerR2))}
    {print(paste("Power b1 = ", powerb1))}
    {print(paste("Power b2 = ", powerb2))}
     }

  if (pred=="3")
    {
  pop <- mvrnorm(n, mu = c(my, m1, m2, m3), Sigma = matrix(c(sy, ry1, ry2, ry3, ry1, s1, r12, r1
3, ry2, r12,s2, r23, ry3, r13, r23, s3),
                 ncol = 4), empirical = TRUE)
  pop2 = data.frame(pop)

  values<-lm(X1~X2+X3+X4, pop2)
  values<-summary(values)

  int<-(values$coefficients)[1,3]
  tb1<-(values$coefficients)[2,3] #grabs t from each analysis
  tb2<-(values$coefficients)[3,3]
  tb3<-(values$coefficients)[4,3]
  R2<-values$r.squared
  F<-values$fstatistic[1]
  df1<-values$fstatistic[2]
  df2<-values$fstatistic[3]

  f2<-R2/(1-R2)
  lambdaR2<-f2*df2
  minusalpha<-1-alpha
  FtR2<-qf(minusalpha, df1, df2)
  powerR2<-round(1-pf(FtR2, df1,df2,lambdaR2),3)

  lambdab1<-tb1^2
  lambdab2<-tb2^2
  lambdab3<-tb3^2
  Fb<-qf(minusalpha, 1, df2)
  powerb1<-round(1-pf(Fb, 1,df2,lambdab1),3)
  powerb2<-round(1-pf(Fb, 1,df2,lambdab2),3)
  powerb3<-round(1-pf(Fb, 1,df2,lambdab3),3)


  {print(paste("Sample size is ",n))}
  {print(paste("Power R2 = ", powerR2))}
  {print(paste("Power b1 = ", powerb1))}
  {print(paste("Power b2 = ", powerb2))}
  {print(paste("Power b3 = ", powerb3))}

   }}



##r2 ok
pwr.MRC(.44,.26,.29,.50,.31,.37,50)
```

```
## [1] "Sample size is  50"
## [1] "Power R2 =  0.837"
## [1] "Power b1 =  0.698"
## [1] "Power b2 =  0.05"
## [1] "Power b3 =  0.214"
```

```
##Stress
pwr.MRC(.44,.26,.29,.50,.31,.37,100)
```

```
## [1] "Sample size is  100"
## [1] "Power R2 =  0.995"
## [1] "Power b1 =  0.951"
## [1] "Power b2 =  0.05"
## [1] "Power b3 =  0.398"
```

```
##physical
pwr.MRC(.44,.26,.29,.50,.31,.37,300)
```

```
## [1] "Sample size is  300"
## [1] "Power R2 =  1"
## [1] "Power b1 =  1"
## [1] "Power b2 =  0.051"
## [1] "Power b3 =  0.852"
```