Randomization tests

```
% cat sleep.data
    extra group
1     0.7     1
2    -1.6     1
3    -0.2     1
4    -1.2     1
5    -0.1     1
6     3.4     1
7     3.7     1
8     0.8     1
9     0.0     1
10    2.0     1
11    1.9     2
12    0.8     2
13    1.1     2
14    0.1     2
15   -0.1     2
16    4.4     2
17    5.5     2
18    1.6     2
19    4.6     2
20    3.4     2
%
% cat randex1.R
# randex1.R :  First randomization test example, with Student's Sleep Data
# Monte Carlo sample size m may be set interactively

# Define margin of error functions
merror <- function(phat,M,alpha) # (1-alpha)*100% merror for a proportion
    {
    z <- qnorm(1-alpha/2)
    merror <- z * sqrt(phat*(1-phat)/M)  # M is (Monte Carlo) sample size
    merror
    }
mmargin <- function(p,cc,alpha)
            # Choose m to get (1-alpha)*100% margin of error equal to cc
            {
            mmargin <- p*(1-p)*qnorm(1-alpha/2)^2/cc^2
            mmargin <- trunc(mmargin+1) # Round up to next integer
            mmargin
            } # End definition of function mmargin
##############
sleepy <- read.table("sleep.data")
cat("Traditional 2-sample t-test \n")
print(t.test(extra ~ group, var.equal=TRUE, data = sleepy))

ObsT <- t.test(extra ~ group, var.equal=TRUE, data = sleepy)[[1]]
cat("Observed T = ",ObsT," \n")

# If M is not assigned, it's 1210
if(length(objects(pattern="M"))==0) M <- 1210
cat("Monte Carlo Sample size M = ",M,"\n")
dv <- sleepy$extra ; iv <- sleepy$group
trand <- numeric(M)
```

```
for(i in 1:M)
    { trand[i] <- t.test(sample(dv) ~ iv, var.equal=TRUE)[[1]] }
randp <- length(trand[abs(trand)>abs(ObsT)])/M
margin <- merror(randp,M,.01)

cat ("\n")
cat ("Randomization p-value = ",randp,"\n")
cat("99% CI from ",(randp-margin)," to ",(randp+margin),"\n")
cat ("\n")

% R

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> source("randex1.R ")
Error in file(file, "r") : unable to open connection
In addition: Warning message:
cannot open file `randex1.R '
> source("randex1.R")
Traditional 2-sample t-test

        Two Sample t-test

data:  extra by group
t = -1.8608, df = 18, p-value = 0.07919
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -3.3638740  0.2038740
sample estimates:
mean in group 1 mean in group 2
          0.75            2.33

Observed T =  -1.860813
Monte Carlo Sample size M =  1210

Randomization p-value =  0.08842975
99% CI from  0.06740559  to  0.1094539
```