# Math 490 HW #17

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## Question 1.

**Use our class data to carry out the permuation test on whether gender and sleep are independent. Report the P-value and draw your conclusion at a level of significance of $\alpha = 10\%$.**

First we state our hypotheses; our null hypothesis is that gender and sleep are independent and our alternative hypothesis is that gender and sleep are not independent.

Now we can run a permutation test on whether gender and sleep are independent by running the following code in R:

```r
# making a 2 x 2 table
original = matrix(c(4, 5, 8, 5), nrow = 2, byrow = T)

# computing the likelihood of the observed table
obsProb = choose(9, 4) * choose(13, 8) / choose(22, 12)

permTest = function(x, y, rep) {
  # x is the category label like treatments
  # y is the category variable like outcomes
    count = 0
    for (i in 1:rep) {
        xPerm = sample(x)  # a random permuation of label x
        dataPerm = data.frame(y, xPerm)
        tab = table(y, xPerm)
        # print(tab)    # use this to verify the permuted table
        if (choose(sum(tab[1,]), tab[1,1]) * choose(sum(tab[2,]), tab[2,1])
            / choose(sum(tab), sum(tab[,1])) <= obsProb) {
          count = count + 1
        }
    }
    count / rep
}

# Get the data
our_data = read.table("math490.R", header=TRUE)
attach(our_data)

outcome = rep(c("Early", "Night"), c(9, 13))
treatment = rep(c("Female", "Male"), c(12, 10))
outAndTreat = data.frame(gender, sleep_type)
permTest(gender, sleep_type, 1024)
```

```
[1] 0.6660156
```

This gives us a P-value of about 0.6, which is way larger than our $\alpha$ value. Thus we do not have sufficient evidence to reject the null hypothesis that gender and sleep are independent.