HW4 STAT COMP

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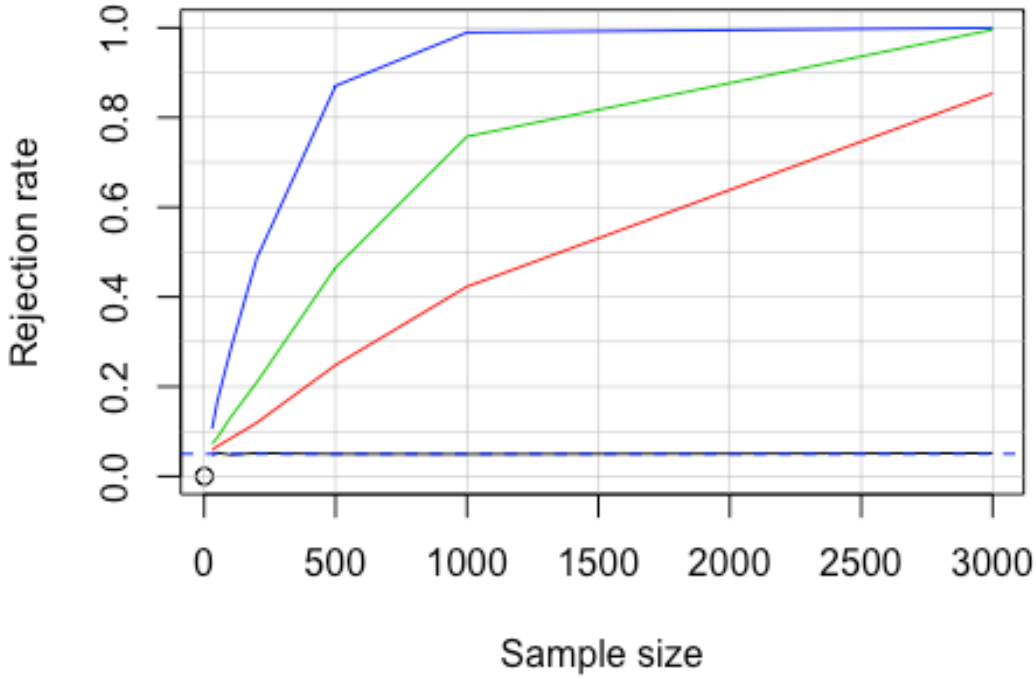
11/17/2019

Question 1: power analysis for main effects

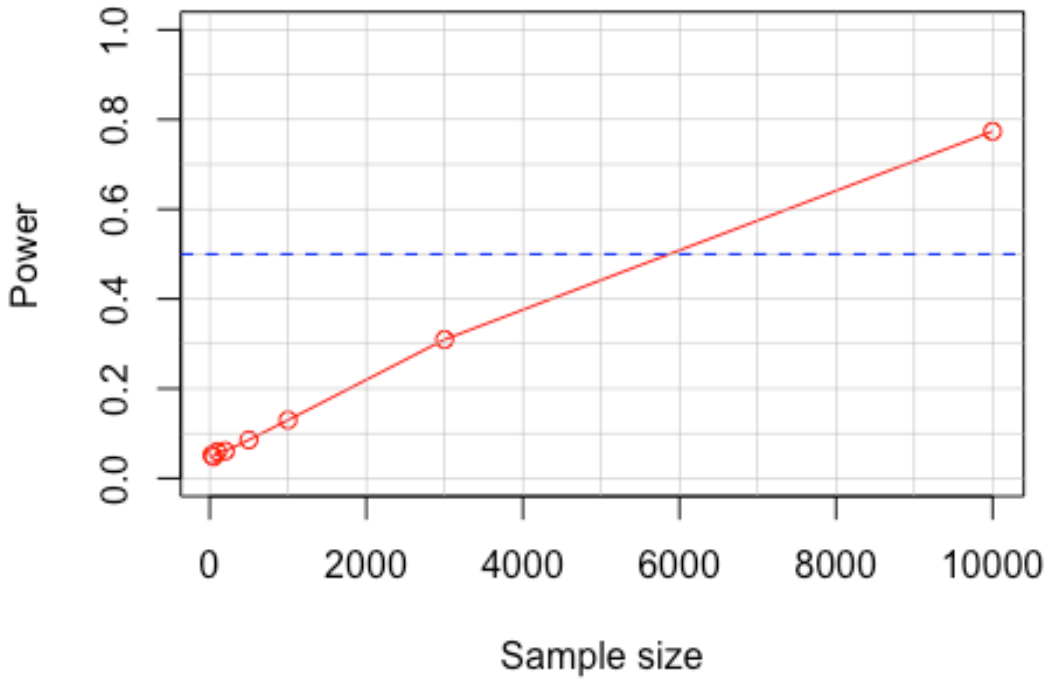
```
N=c(30,50,100,200,500,1000,3000)
EFFECTS=c(0,0.2,0.3,0.5)
nRep=5000

REJ_RATE=matrix(nrow=length(N),ncol=length(EFFECTS),0)
rownames(REJ_RATE)=N
colnames(REJ_RATE)=EFFECTS


for(i in 1:length(N)){
    n=N[i]

    for(j in 1:length(EFFECTS)){

        b2=EFFECTS[j]

        for(k in 1:nRep){
            M=rep(0:1,each=n/2) # male dummy variable
            BMI=ifelse(M==0,rnorm(mean=26.5,sd=sqrt(30),n=n/2),
                            rnorm(mean=27.4,sd=sqrt(16.7),n=n/2)
                )
            Z=BMI-mean(BMI)
            signal=120-3*M+b2*Z
            error=rnorm(n,sd=sqrt(300))
            SBP=signal+error

            pVal=summary(lm(SBP~M+BMI))$coef[3,4]
            REJ_RATE[i,j]=REJ_RATE[i,j]+(pVal<0.05)/nRep

        }
    }
}


plot(0,ylim=c(0,1),xlim=range(N),ylab='Rejection rate',xlab='Sample size')
abline(h=seq(from=0,to=1,by=.1),col=8,lwd=.5)
abline(v=seq(from=0,to=max(N),by=500),lwd=.5,col=8)

for(i in 1:ncol(REJ_RATE)){
    lines(x=N,y=REJ_RATE[,i],col=i)

}

abline(h=.05,col=4,lty=2)
```



Answer: We need a sample size of at least 1,500 to reach a power of 0.8 with an effect size of 0.3.

Question 2: power analysis for interaction effects

```
N=c(30,50,100,200,500,1000,3000,10000)
nRep=5000
REJ_RATE=rep(0,length(N))

bM=0.4
bF=0.2


for(i in 1:length(N)){
    n=N[i]

    for(k in 1:nRep){
            M=rep(0:1,each=n/2) # male dummy variable
            BMI=ifelse(M==0,rnorm(mean=26.5,sd=sqrt(30),n=n/2),rnorm(mean=27.4,sd=sqrt(16.7),n
=n/2))
            Z=BMI-mean(BMI)
            signal=120-3*M+bM*M*Z+bF*(1-M)*Z
            error=rnorm(n,sd=sqrt(300))
            SBP=signal+error

            pVal=summary(lm(SBP~M+BMI+BMI*M))$coef[4,4]
            REJ_RATE[i]=REJ_RATE[i]+(pVal<0.05)/nRep

    }
}

plot(REJ_RATE~N,ylab='Power', xlab='Sample size',ylim=c(0,1),type='o',col=2)
abline(h=seq(from=0,to=1,by=.1),col=8,lwd=.5)
abline(v=seq(from=0,to=max(N),by=1000),lwd=.5,col=8)

abline(h=.5,col=4,lty=2)
```



Answer: Yes, the power analysis suggests that a power of 50% can be achieved with N~6,000.