Stat Comp HW 3

Michael Ackerman

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1)

```
set.seed(72)
powerTest <- function(n = 100){
  half <- n/2
  trts <- c(rep(0,half),rep(1,half)) ##Vector of half 0's, half 1's

  outcome <- c()
  outcome[1:half] <- rnorm(half,60, 20) ## 0's have mu=60
  outcome[half+1:half] <- rnorm(half,65, 20) ## 1's have mu=65

  p = summary(lm(outcome ~ trts))$coefficients[2,4]
  ifelse(p<=.05, 1,0) ## Assign 0 or 1 to p values
}

rp1000 <- function(n=100){ ##repeat this procedure 1000 times for n-sized   sample
x<- matrix(n,ncol=1000)
x<- apply(x,2,powerTest)
sum(x)/1000 ##Avg number of p<=.05
}
```

Now that we've established a few functions we can answer the quesitons for various N values:

```
N <- c(100,1000)
Power <- c(rp1000(100), rp1000(1000))
cbind(N,Power)
```

```
##         N Power
## [1,]  100 0.236
## [2,] 1000 0.974
```

2)

```
require(MASS)
```

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

```
proj_rb15 <- read.csv("~/Downloads/football-values-master/2015/proj_rb15.csv")
d <- proj_rb15[,-1:-2]
round(cor(d), digits=4)
```

```
##          rush_att rush_yds rush_tds rec_att rec_yds rec_tds fumbles   fpts
## rush_att   1.0000   0.9976   0.9724  0.7694  0.7403  0.5969  0.8589 0.9824
## rush_yds   0.9976   1.0000   0.9775  0.7646  0.7345  0.6021  0.8583 0.9843
```

```
## rush_tds   0.9724   0.9775   1.0000  0.7264  0.6985  0.5908  0.8527 0.9689
## rec_att    0.7694   0.7646   0.7264  1.0000  0.9944  0.8384  0.7459 0.8557
## rec_yds    0.7403   0.7345   0.6985  0.9944  1.0000  0.8519  0.7225 0.8340
## rec_tds    0.5969   0.6021   0.5908  0.8384  0.8519  1.0000  0.6056 0.7134
## fumbles    0.8589   0.8583   0.8527  0.7459  0.7225  0.6056  1.0000 0.8636
## fpts       0.9824   0.9843   0.9689  0.8557  0.8340  0.7134  0.8636 1.0000
```

```
######################### Part 2

mess = function(val) return(val + rnorm(1, 0, 0.05))

cor_sum <- matrix(0, 8,8) #Initialize a matrix
n <- 10000
for(i in 1:n){
 new_cor <- apply(cor(d),c(1, 2),  mess) #make a similar correlation matrix ##### c(1,2) does it to bot
 approx <- mvrnorm(30, colMeans(d), new_cor,8,8) #Generate data with that correlation matrix
 cor_sum = cor_sum + cor(approx) #add to aggregate matrix
}

A <- cor_sum/n #Find average
diag(A) <- rep(1,8) #So that ppl dont laugh at us
round(A, digits=4)
```

```
##          rush_att rush_yds rush_tds rec_att rec_yds rec_tds fumbles   fpts
## rush_att   1.0000   0.9500   0.9360  0.7466  0.7191  0.5882  0.8417 0.9371
## rush_yds   0.9500   1.0000   0.9390  0.7419  0.7147  0.5927  0.8415 0.9377
## rush_tds   0.9360   0.9390   1.0000  0.7109  0.6834  0.5809  0.8363 0.9271
## rec_att    0.7466   0.7419   0.7109  1.0000  0.9471  0.8245  0.7341 0.8235
## rec_yds    0.7191   0.7147   0.6834  0.9471  1.0000  0.8360  0.7110 0.8038
## rec_tds    0.5882   0.5927   0.5809  0.8245  0.8360  1.0000  0.6032 0.6959
## fumbles    0.8417   0.8415   0.8363  0.7341  0.7110  0.6032  1.0000 0.8445
## fpts       0.9371   0.9377   0.9271  0.8235  0.8038  0.6959  0.8445 1.0000
```

```
######################### Part 3

exact <- mvrnorm(30, colMeans(d), cor(d), empirical=T)
round(cor(exact), digits=4)
```

```
##          rush_att rush_yds rush_tds rec_att rec_yds rec_tds fumbles   fpts
## rush_att   1.0000   0.9976   0.9724  0.7694  0.7403  0.5969  0.8589 0.9824
## rush_yds   0.9976   1.0000   0.9775  0.7646  0.7345  0.6021  0.8583 0.9843
## rush_tds   0.9724   0.9775   1.0000  0.7264  0.6985  0.5908  0.8527 0.9689
## rec_att    0.7694   0.7646   0.7264  1.0000  0.9944  0.8384  0.7459 0.8557
## rec_yds    0.7403   0.7345   0.6985  0.9944  1.0000  0.8519  0.7225 0.8340
## rec_tds    0.5969   0.6021   0.5908  0.8384  0.8519  1.0000  0.6056 0.7134
## fumbles    0.8589   0.8583   0.8527  0.7459  0.7225  0.6056  1.0000 0.8636
## fpts       0.9824   0.9843   0.9689  0.8557  0.8340  0.7134  0.8636 1.0000
```

3)

$$P(B) = \sum_j P(B|A_j)P(A_j),$$

$$\Rightarrow P(A_i|B) = \frac{P(B|A_i)P(A_i)}{\sum_j (B|A_j)P(A_j)}$$

$$\hat{f}(\zeta) = \int_{-\infty}^{\infty} f(x) e^{-2\pi i x \zeta} dx$$

$$\mathbf{J} = \frac{d\mathbf{f}}{d\mathbf{x}} = \left[\frac{\partial \mathbf{f}}{\partial x_1} \cdots \frac{\partial \mathbf{f}}{\partial x_n} \right] = \begin{bmatrix} \frac{\partial f_1}{\partial x_1} & \cdots & \frac{\partial f_1}{\partial x_n} \\ \vdots & \ddots & \vdots \\ \frac{\partial f_m}{\partial x_1} & \cdots & \frac{\partial f_m}{\partial x_n} \end{bmatrix}$$