

# HW3

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## Problem 1

```
a <- c(1:10)
b <- c(0:9)
paste("c_{",a,"}X_{",a,"}^",b,sep="",collapse = "+")

## [1] "c_{1}X_{1}^0+c_{2}X_{2}^1+c_{3}X_{3}^2+c_{4}X_{4}^3+c_{5}X_{5}^4+c_{6}X_{6}^5+c_{7}X_{7}^6+c_{8}X_{8}^7+c_{9}X_{9}^8+c_{10}X_{10}^9"
```

## Problem 2

1

```
ptm <- proc.time()
n <- 1000000
c=0
for(i in 1:n){
  sample_space <- c( rep("Y",3), rep("B" , 7 ))
  if(sum(sample(sample_space,3, replace=F)== "Y")==1)
    {c=c+1}
  else{
    c=c
  }
}
print(c/n)
```

```
## [1] 0.524912
```

```
proc.time() - ptm
```

```
##      user  system elapsed
##   11.28    0.00    11.28
```

2

```
ptm <- proc.time()
n <- 1000000
c=0
for(i in 1:n){
  sample_space <- c( rep("Y" ,3), rep("B" , 7 ))
  d = ifelse(sum(sample(sample_space,3, replace=F)== "Y")==1,1,0)
  c = c+d
}
print(c/n)
```

```
## [1] 0.524979
```

```
proc.time() - ptm
```

```
##      user  system elapsed
##    14.26    0.00   14.29
```

### 3

```
ptm <- proc.time()
n <- 1000000
sample_space <- c( rep(1,3), rep(0 , 7))
s <- sum(sapply(1:n,function(x) sum(sample_space[sample(x=1:10,3,replace=F)]==1,simplify = T))
print(s/n)
```

```
## [1] 0.525582
```

```
proc.time() - ptm
```

```
##      user  system elapsed
##     9.92    0.02    9.94
```

the time of the 3rd way is the least one, we can see the speeds of for loops are not vary fast.

## Problem3

### 1

The probability that at most one yellow fish gets selected equals to the sum of probabilities that only one yellow fish gets selected and no yellow fish gets selected.

```
n <- 1000000
sample_space <- c( rep(1,3), rep(0 , 7))
s1 <- sum(sapply(1:n,function(x) sum(sample_space[sample(x=1:10,3,replace=F)]==1,simplify = T))
s0 <- sum(sapply(1:n,function(x) sum(sample_space[sample(x=1:10,3,replace=F)]==0,simplify = T))
(s1+s0)/n
```

```
## [1] 0.815493
```

### 2

the probability that at least one yellow fish gets selected equals to 1 minus the probability that no yellow fish gets selected

```
n <- 1000000
sample_space <- c( rep(1,3), rep(0 , 7))
s0 <- sum(sapply(1:n,function(x) sum(sample_space[sample(x=1:10,3,replace=F)]==0,simplify = T))
1-s0/n
```

```
## [1] 0.708723
```

## Problem4

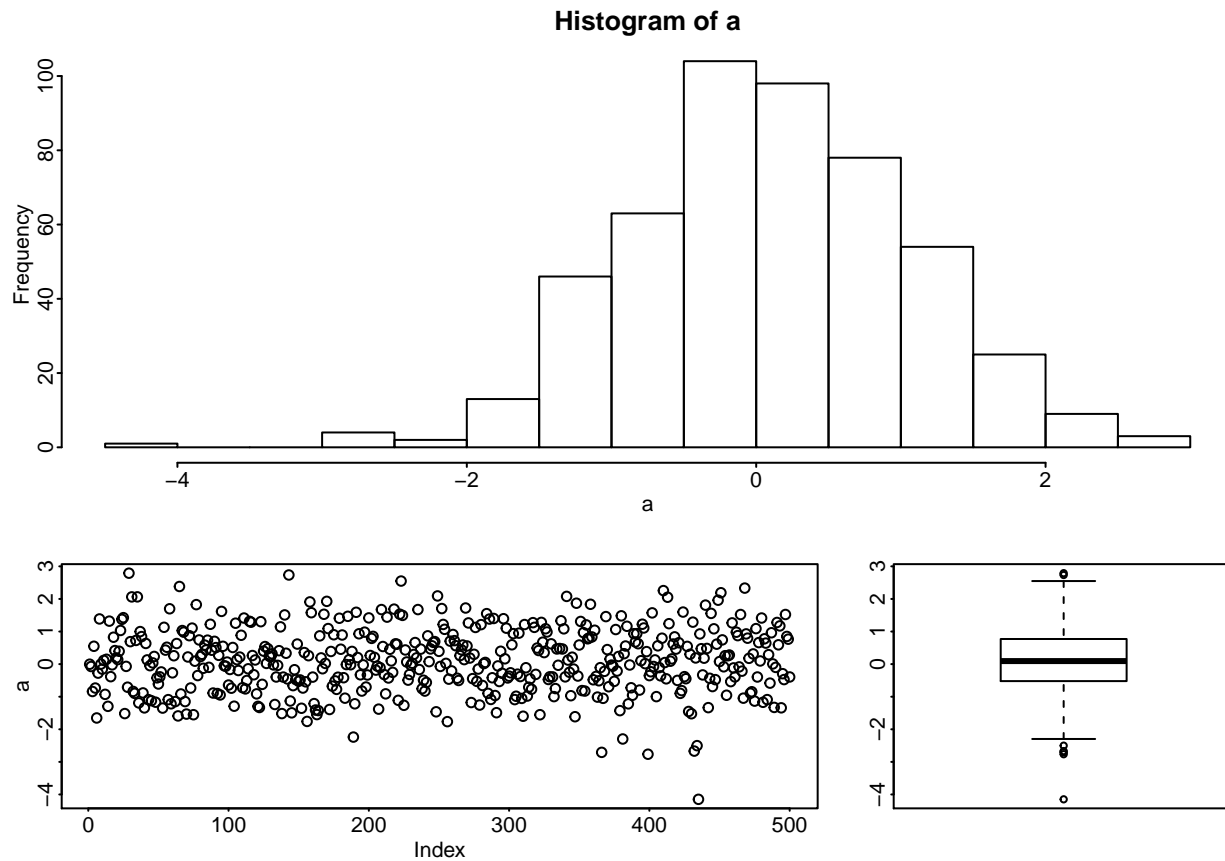
```
par(mar= c(2 , 2, 2, 1),
mgp= c(1.1, 0.15 , 0),
tck= -0.01 )
a <- rnorm ( 500 )
layout(mat= matrix( c(2,2,2,
```

```

2,2,2,
2,2,2,
1,1,3,
1,1,3),5,byrow=TRUE))

plot(a)
hist(a)
boxplot (a)

```



## Problem5

```

s <- matrix(sapply(1:100, function(x) rnorm (10,10,2)),nr=100)
x <- rowMeans(s)
CIlow <- x - 2*1.96/sqrt(10)
CIhigh <- x + 2*1.96/sqrt(10)
d <- CIlow <= 10 & CIhigh >= 10
y <- 1:100
plot(x,y,xlab = "True mean(in blue) and CIs", ylab = "cases",xlim = c(7,13), ylim =c(0,100),main = paste0("n=",100))
abline(v=10,col="blue",lwd=2,lty = 'dashed')
segments(CIlow,y,CIhigh,y,col=ifelse(d,"darkgreen","red"),lwd=1)

```

