Hw5

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Question 1

Part A

```
finv <- function(u,l,g){

  (log(1-u)/-l)+g*(u>=g)
}



f_X <- function(x,l,g) {
  l-exp(-l*(x-g)) * (x >= l & l > 0 & g>=0)
}

n<-1000
u <- runif(n, 0, 1)
sample <- finv(u,1,0)
```

Part B

```
envelope <- function(x){
  5.5*dnorm(x,0.5,3)
}
n <- 1000
accepted <- 0
samples <- rep(NA, n)
  while(accepted < n) {

   y <- rnorm(1,0.5,3)


    u <- runif(1)

    if(u < f_X(y,1,0)/envelope(y)) {

    accepted <- accepted + 1
    samples[accepted] <- y
    }
  }
```

Part C

Question 2

Part A

```
f <-function(x,s) {

  exp((-x^2)/(2*s^2))*x/s^2
}


envelope <- function(x){
  5.5*dnorm(x,0.5,3)
}
x <- seq(0, 5, length.out = 100)



median <- rep(NA,100)
m<-1

while(m<=100){
n <- 3
accepted <- 0
samples <- rep(NA, n)
  while(accepted < n) {

   y <- rnorm(1,0.5,3)


    u <- runif(1)

    if(u < f(y,1)/envelope(y)) {

    accepted <- accepted + 1
    samples[accepted] <- y
    }
}

samples<-sort(samples)

median[m] <- median(samples)

m<-m+1

}
```

Part B

```
f <-function(x,s) {

  exp((-x^2)/(2*s^2))*x/s^2
}


envelope <- function(x){
  5.5*dnorm(x,0.5,3)
}
x <- seq(0, 5, length.out = 100)



median2 <- rep(NA,100)
m<-1

while(m<=100){
n <- 100
accepted <- 0
samples <- rep(NA, n)
  while(accepted < n) {

   y <- rnorm(1,0.5,3)


    u <- runif(1)

    if(u < f(y,1)/envelope(y)) {

    accepted <- accepted + 1
    samples[accepted] <- y
    }
}

samples<-sort(samples)

median2[m] <- median(samples)

m<-m+1

}
```

Part c

```
f <-function(x,s) {

  exp((-x^2)/(2*s^2))*x/s^2
}
```

```
envelope <- function(x){
  5.5*dnorm(x,0.5,3)
}
x <- seq(0, 5, length.out = 100)



median3 <- rep(NA,100)
m<-1

while(m<=100){
n <- 1000
accepted <- 0
samples <- rep(NA, n)
  while(accepted < n) {

   y <- rnorm(1,0.5,3)


    u <- runif(1)

    if(u < f(y,1)/envelope(y)) {

    accepted <- accepted + 1
    samples[accepted] <- y
    }
}

samples<-sort(samples)

median3[m] <- median(samples)

m<-m+1

}
```

Part d

```
ggplot()+geom_histogram(aes(median, y = ..density..))+xlim(0.9,1.4)+ggtitle("n=3")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 62 rows containing non-finite values (stat_bin).
## Warning: Removed 2 rows containing missing values (geom_bar).
```

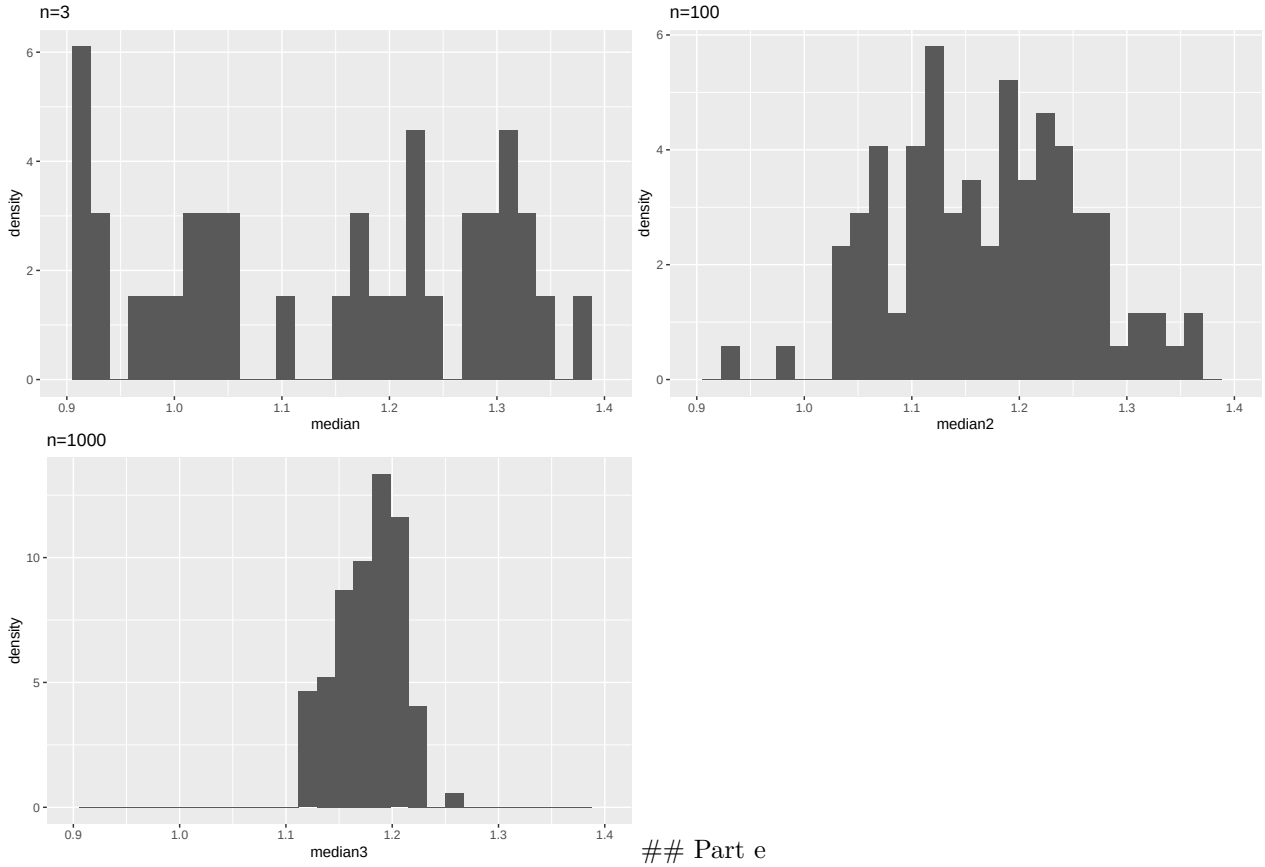
```
ggplot()+geom_histogram(aes(median2, y = ..density..))+xlim(0.9,1.4)+ggtitle("n=100")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 2 rows containing missing values (geom_bar).
```

```
ggplot()+geom_histogram(aes(median3, y = ..density..))+xlim(0.9,1.4)+ggtitle("n=1000")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 2 rows containing missing values (geom_bar).
```



Part e

```
m<-1000

e0 <- mean(median)
e02 <- mean(median2)
e03 <- mean(median3)


se0 <- sqrt(mean((median-e0)^2)/m)
se02 <- sqrt(mean((median2-e02)^2)/m)
se03 <- sqrt(mean((median3-e03)^2)/m)

cat("Mean n3 =",e0)
```

```
## Mean n3 = 1.222456
```

```
cat(" Mean n100 =",e02)
```

```
##  Mean n100 = 1.168885
```

```
cat(" Mean n1000 =",e03)
```

```
##  Mean n1000 = 1.177307
```

```
cat(" SE n3 =",se0)
```

```
##  SE n3 = 0.01513653
```

```r
cat(" SE n100 =",se02)
```

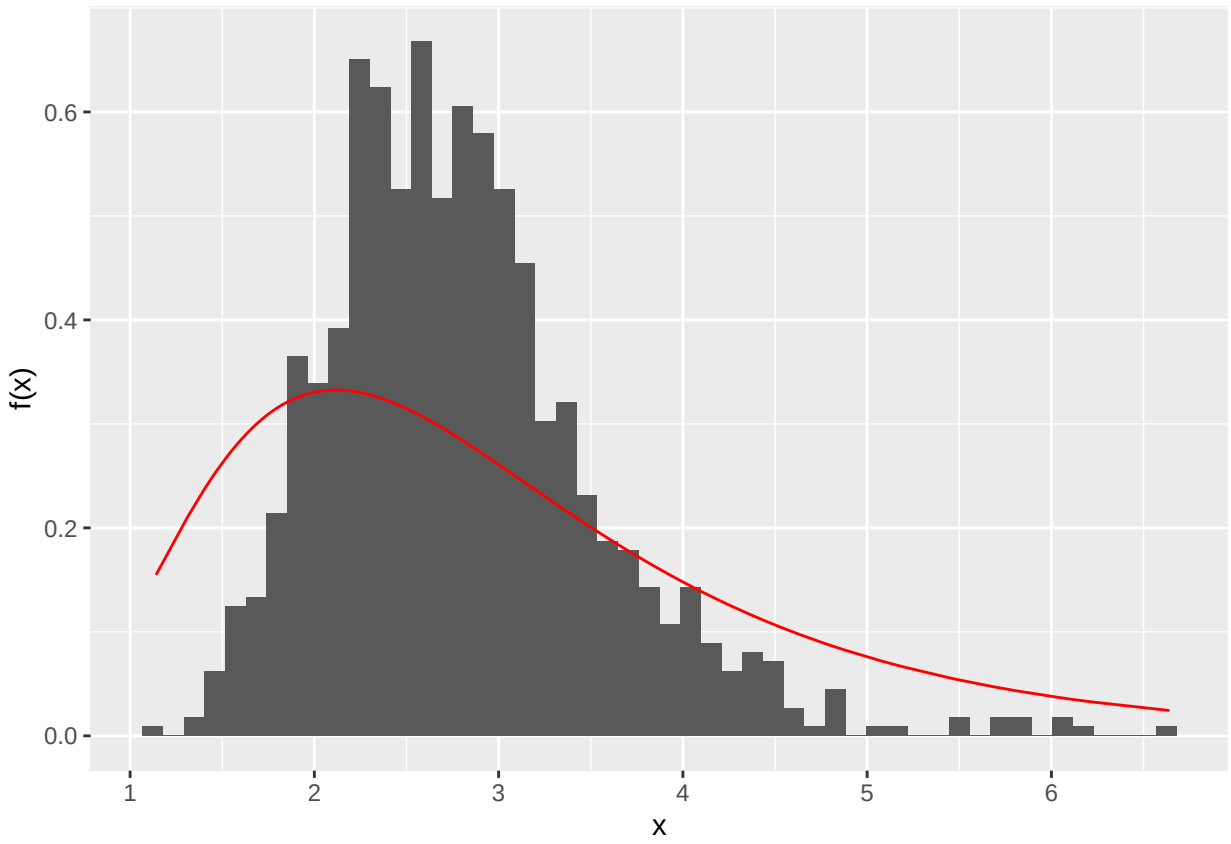
```
##  SE n100 = 0.002757753
```

```r
cat(" SE n1000 =",se03)
```

```
##  SE n1000 = 0.0009290307
```

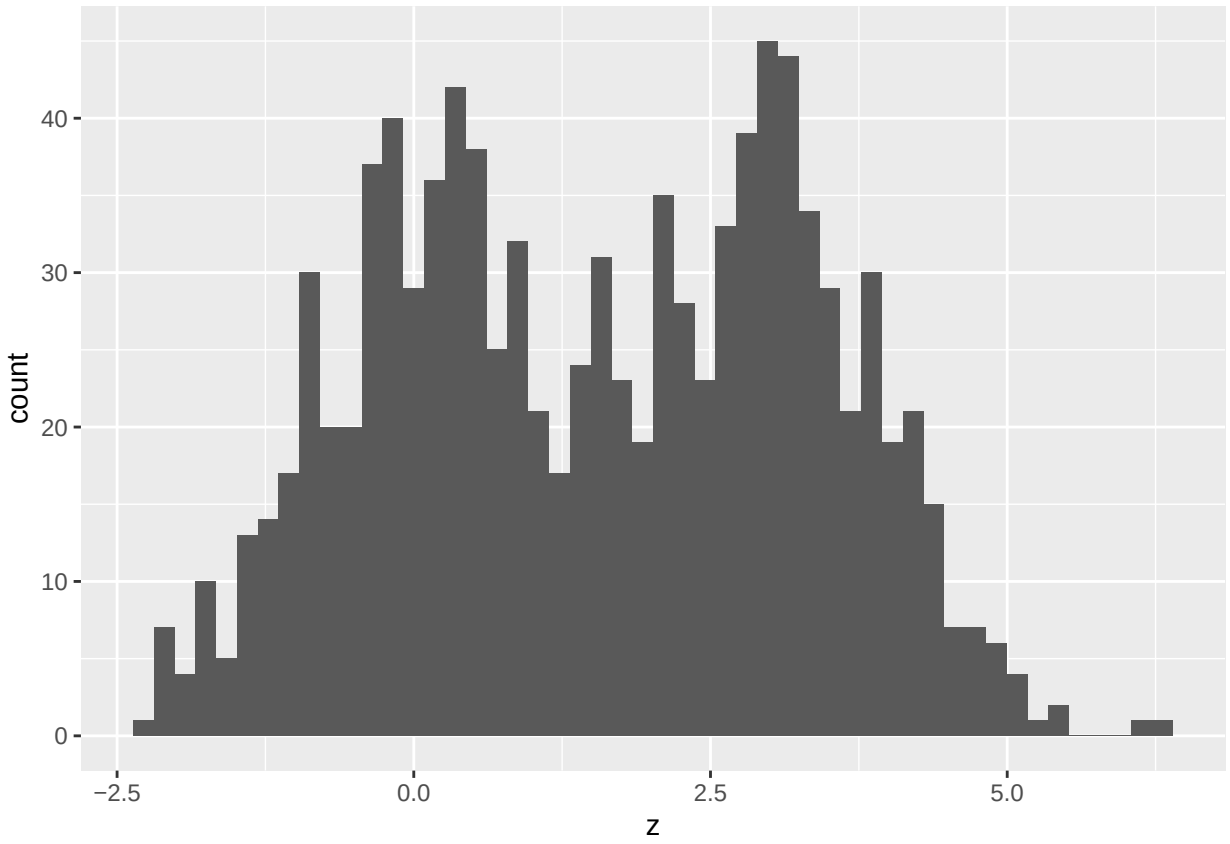
Question 3

```r
logn <- function(n,m,s){

  exp(rnorm(n,m,s))


}

samples <- logn(1000,1,0.25)



ggplot() +
  geom_histogram(aes(samples, y = ..density..), bins = 50, ) +

  geom_line(aes(samples, dlnorm(samples,1,0.5)), colour = "red") +

              xlab("x") +

              ylab("f(x)")
```



Question 4

```
n <- 1000
u <- rbinom(n, 1, 0.5)

z <- u*rnorm(n) + (1 - u)*rnorm(n, 3, 1)

ggplot() +
  geom_histogram(aes(z), bins = 50)
```


40
30
20
10
0
count
−2.5
0.0
2.5
5.0
z