

# Monte Carlo integration

2023-09-27

Vi testar integrera  $Nf(0,1)$  mellan -100,100 svaret bör vara runt ish 1. Vi gör det med monte carlo integration och vi jämför konvergenstiden mellan Pseudo-random variabler(det vanliga) och quasi-random(mer deterministiskt)

```
#monte carlo integration of  $f(x) = x^2$  for the limits  $a=0$ ,  $b=10$ 
n <- 10000
a <- -100
b <- 100

f <- function(x){
  #return( $x^2$ )
  return(1/sqrt(2*pi)*exp(-0.5*(x)^2)) #normalfördelningen
}

#Pseudo random vanliga
uPseudo <- runif(n,min = a,max = b) # OSU urval, kan testa olika
uPseudoSequential <-c()
estimatePseudo <- c()

#Quasi random
uSobol <- a + (b - a) * sobol(n)
uSobolSequential <-c()
estimateSobol <- c()

uKorobov <- a + (b - a) * korobov(n,generator =2)
uKorobovSequential <-c()
estimateKorobov <- c()

uGhalton <- a + (b - a) * ghalton(n)
uGhaltonSequential <-c()
estimateGhalton <- c()

for (i in 1:n) {
  uPseudoSequential <- append(uPseudoSequential, uPseudo[i])
  uSobolSequential <- append(uSobolSequential, uSobol[i])
  uKorobovSequential <- append(uKorobovSequential, uKorobov[i])
  uGhaltonSequential <- append(uGhaltonSequential, uGhalton[i])

  resultPseudo <- (b - a) * mean(f(uPseudoSequential))
  resultSobol <- (b - a) * mean(f(uSobolSequential))
  resultKorobov <- (b - a) * mean(f(uKorobovSequential))
}
```

```

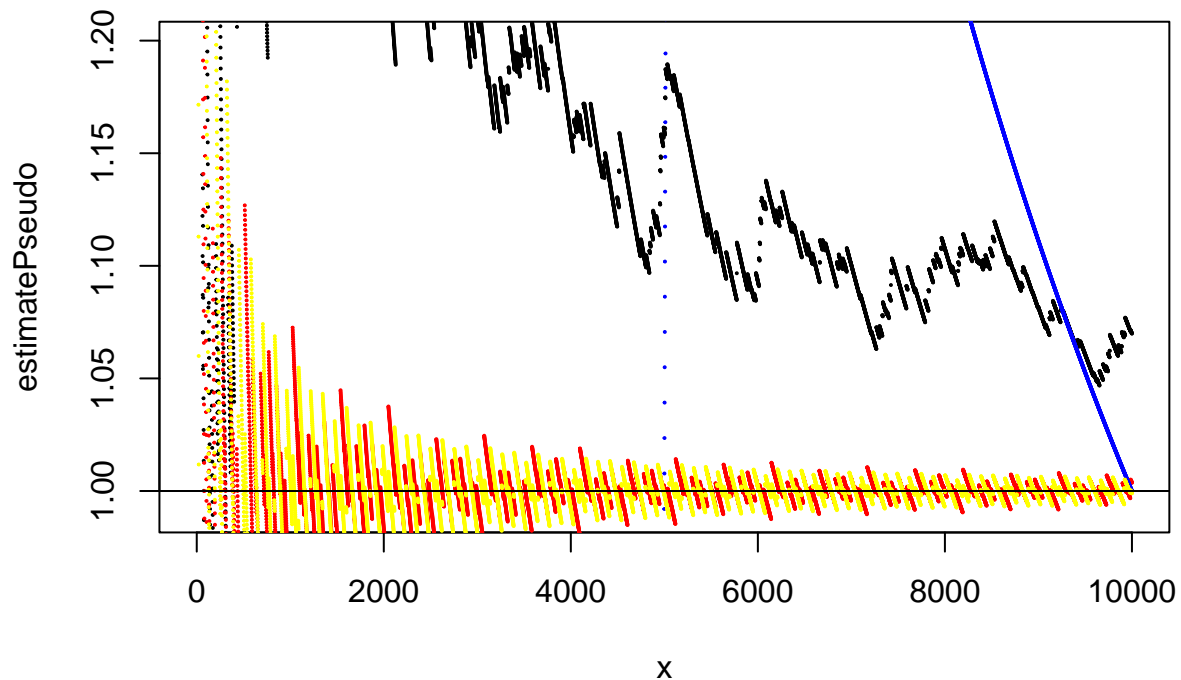
resultGhalton <- (b - a) * mean(f(uGhaltonSequential))

estimatePseudo <- append(estimatePseudo, resultPseudo)
estimateSobol <- append(estimateSobol, resultSobol)
estimateKorobov <- append(estimateKorobov, resultKorobov)
estimateGhalton <- append(estimateGhalton, resultGhalton)

}

x <- seq(1,n)
plot(x,estimatePseudo, cex = 0.2, pch = 20, ylim = c(0.99,1.2))
points(estimateSobol, col = "red", cex = 0.2, pch = 20)
points(estimateKorobov, col = "blue", cex = 0.2, pch = 20)
points(estimateGhalton, col = "yellow", cex = 0.2, pch = 20)
abline(h=1)

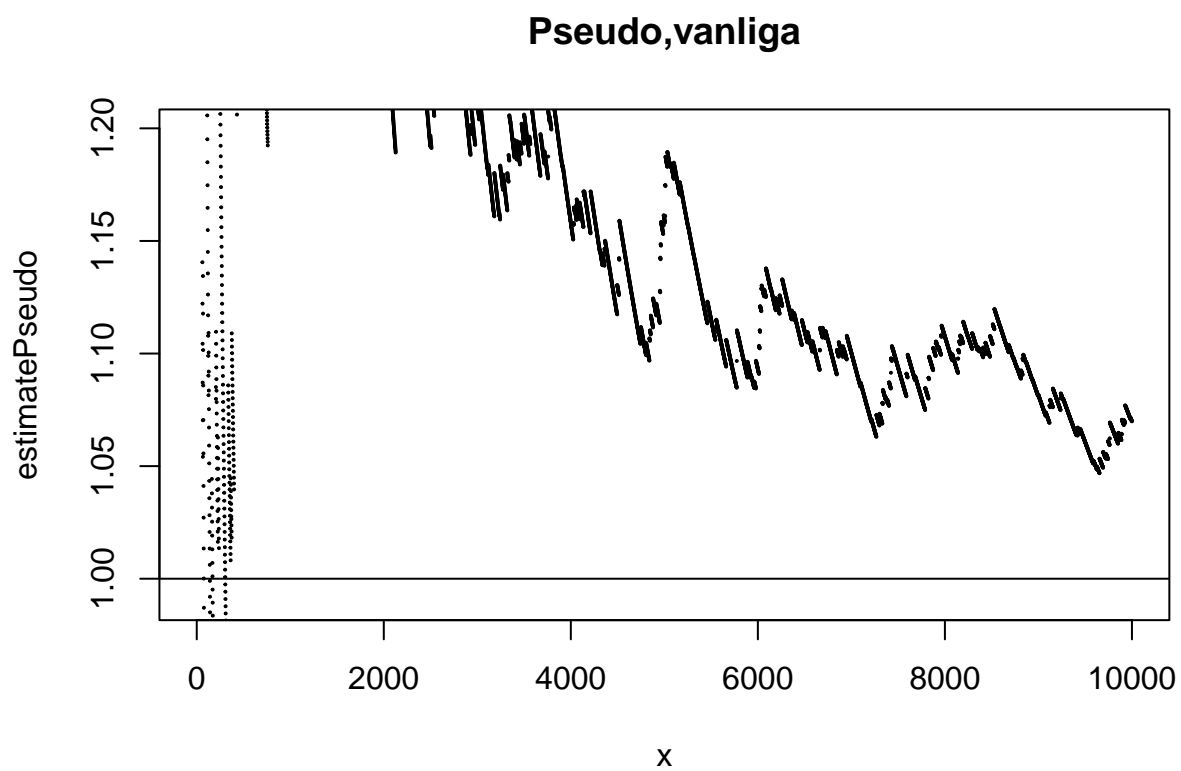
```



```

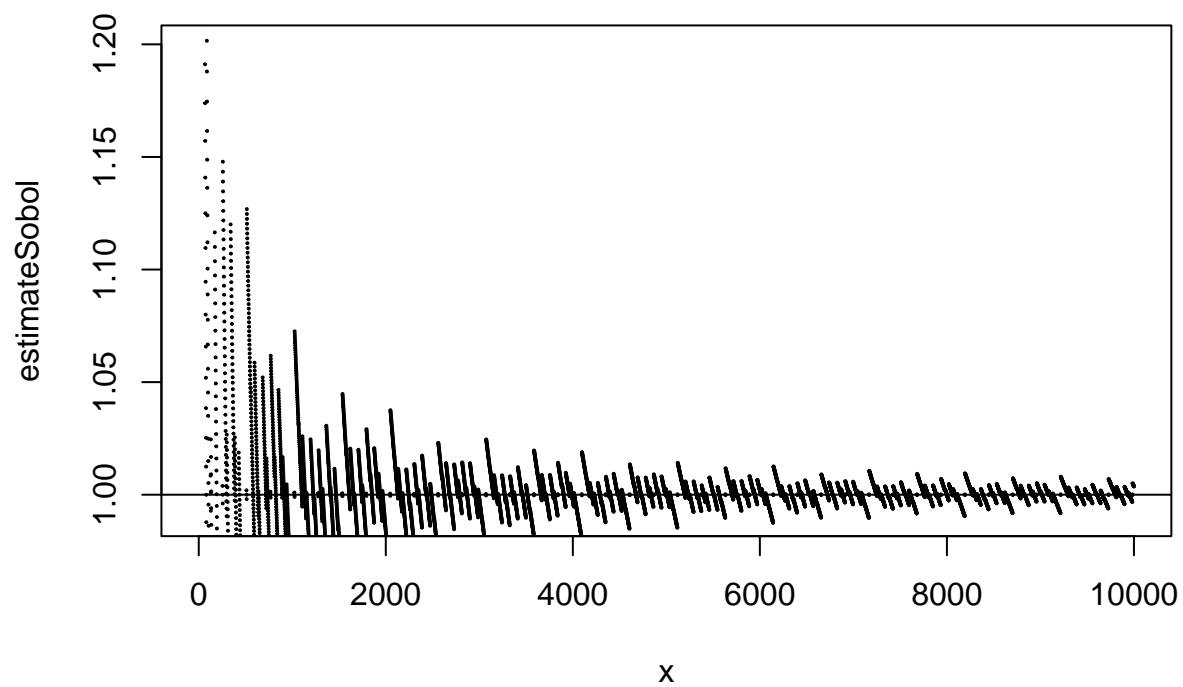
plot(x,estimatePseudo, ylim = c(0.99,1.2),cex = 0.2, pch = 20, main = "Pseudo,vanliga")
abline(h=1)

```



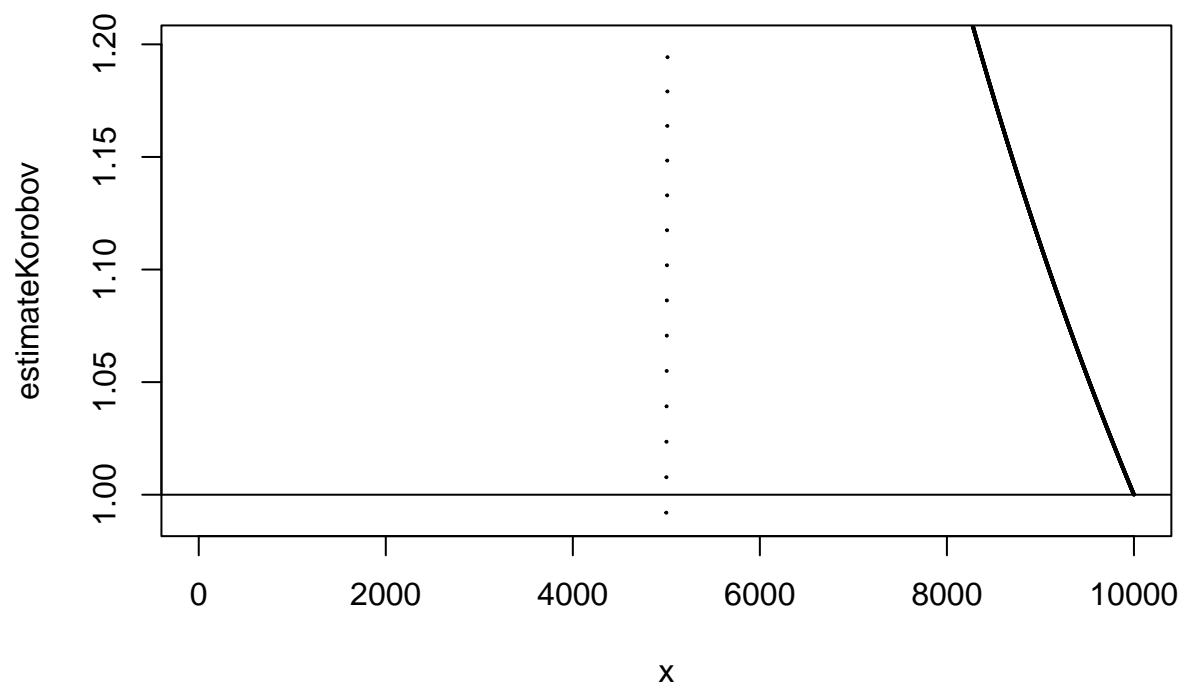
```
plot(x,estimateSobol, ylim = c(0.99,1.2),cex = 0.2, pch = 20, main = "Quasi,Sobol")  
abline(h=1)
```

## Quasi,Sobol



```
plot(x,estimateKorobov, ylim = c(0.99,1.2),cex = 0.2, pch = 20, main ="Quasi,Koroborov??")  
abline(h=1)
```

## Quasi,Koroborov???



```
plot(x,estimateGhalton, ylim = c(0.99,1.2),cex = 0.2, pch = 20, main ="Quasi,Halton")
abline(h=1)
```

## Quasi, Halton

