

HW6

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Exercise 1

Question a

$$p(y|x) \sim \text{Uniform}(\max(0, x - c), \min(x + c, 1))$$

$$p(x|y) \sim \text{Uniform}(\max(0, x - c), \min(x + c, 1))$$

Question b

```
N <- 10^3

x<-rep(0,N)
y<-rep(0,N)
c<- c(0.25,0.05,0.02)

GS <- function(c){
  y[1] <- 0.9
  x[1] <- 0.85

  for (i in 2:N){
    y[i] <- runif(1,max(0,x[i-1]-c),min(x[i-1]+c,1))
    x[i] <- runif(1,max(0,y[i]-c),min(y[i]+c,1))
  }

  xseq <-seq(1,N)
  #traceplot of x
  plot(xseq,x)
  lines(xseq,x)
  #traceplot of y
  plot(xseq,y)
  lines(xseq,y)

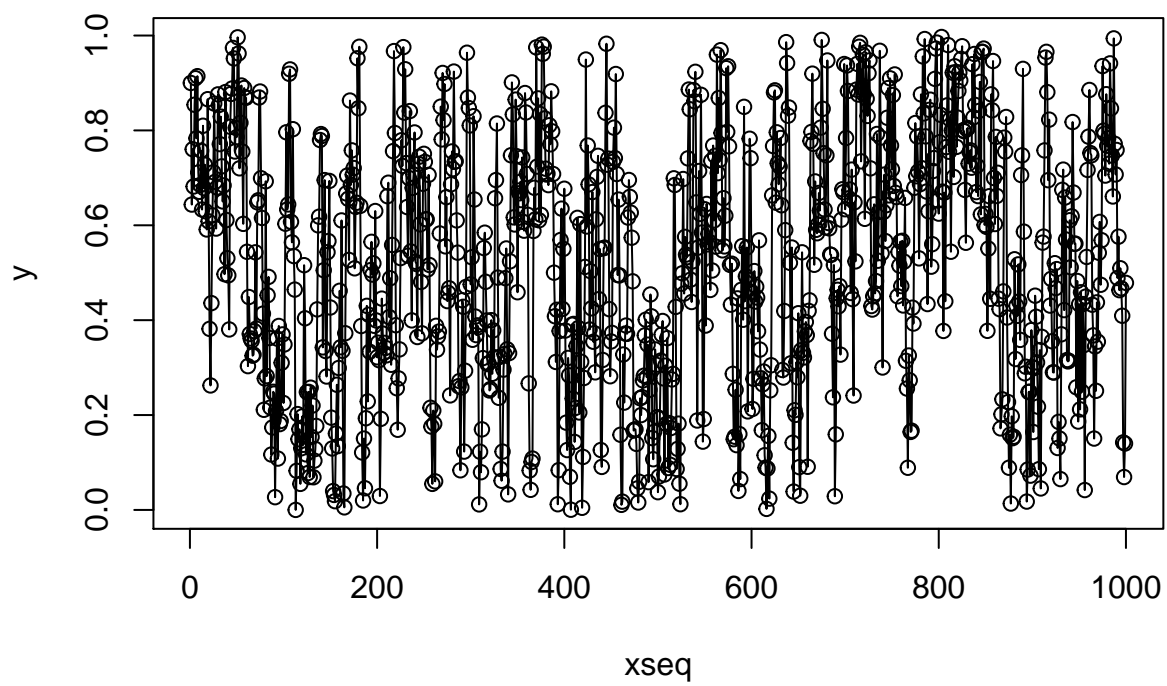
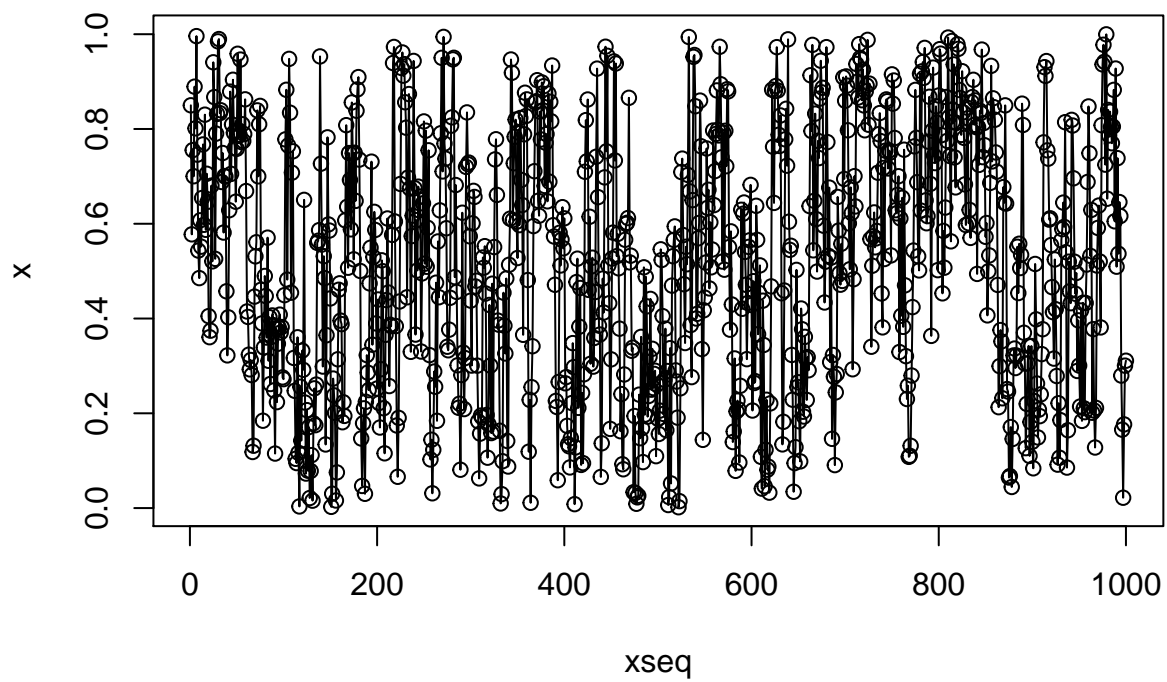
  #scatterplot
  plot(x,y)

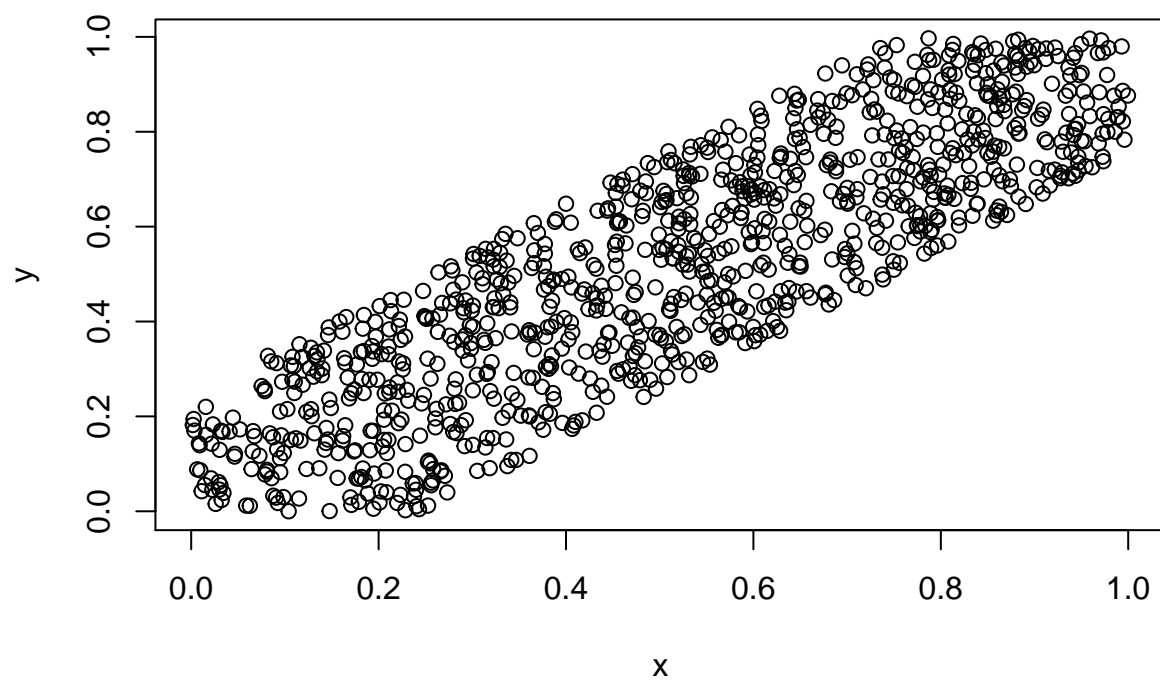
  return (NULL)
}
```

Question c

when $c = 0.25$

```
GS(c[1])
```

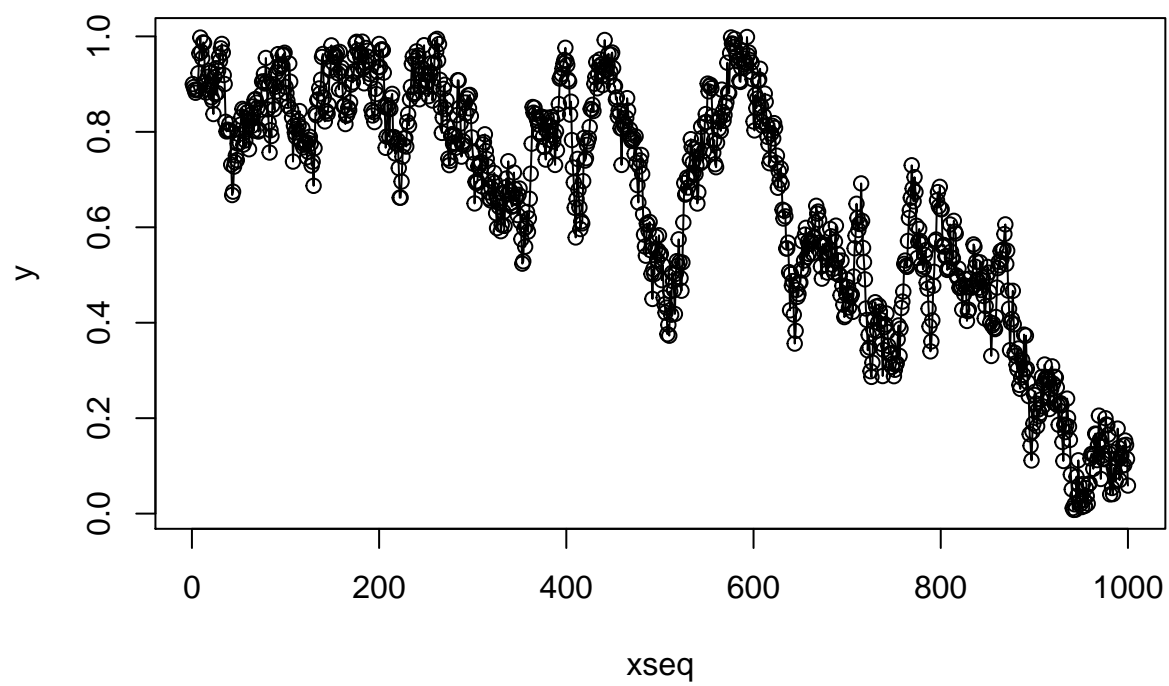
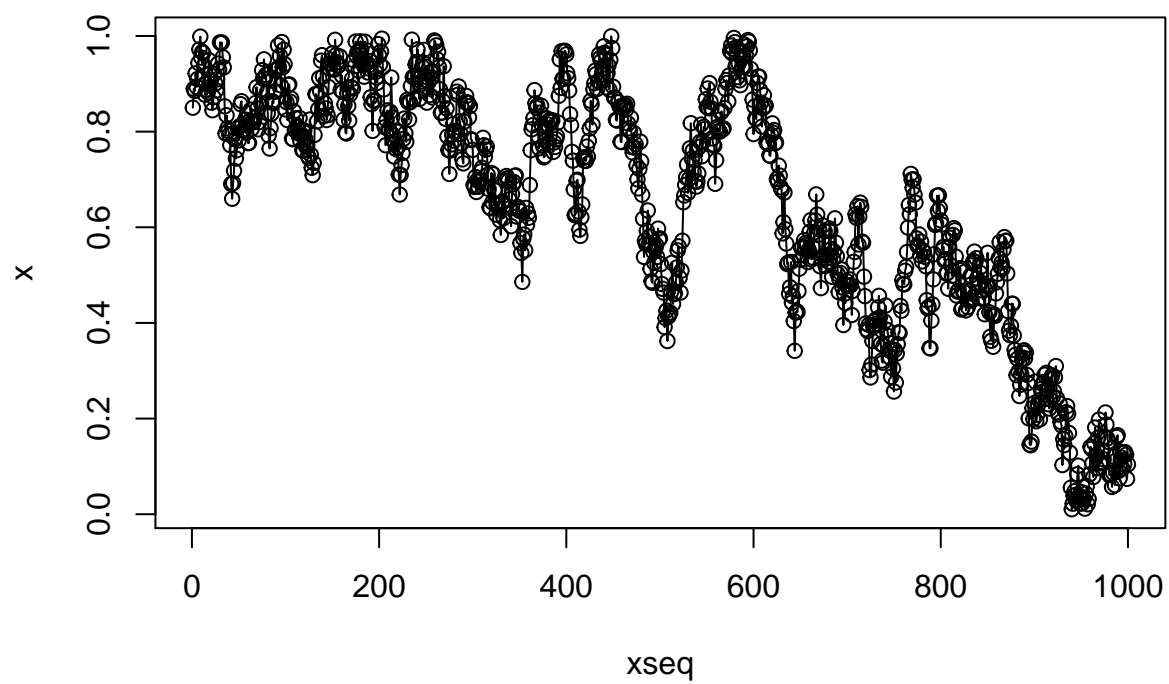


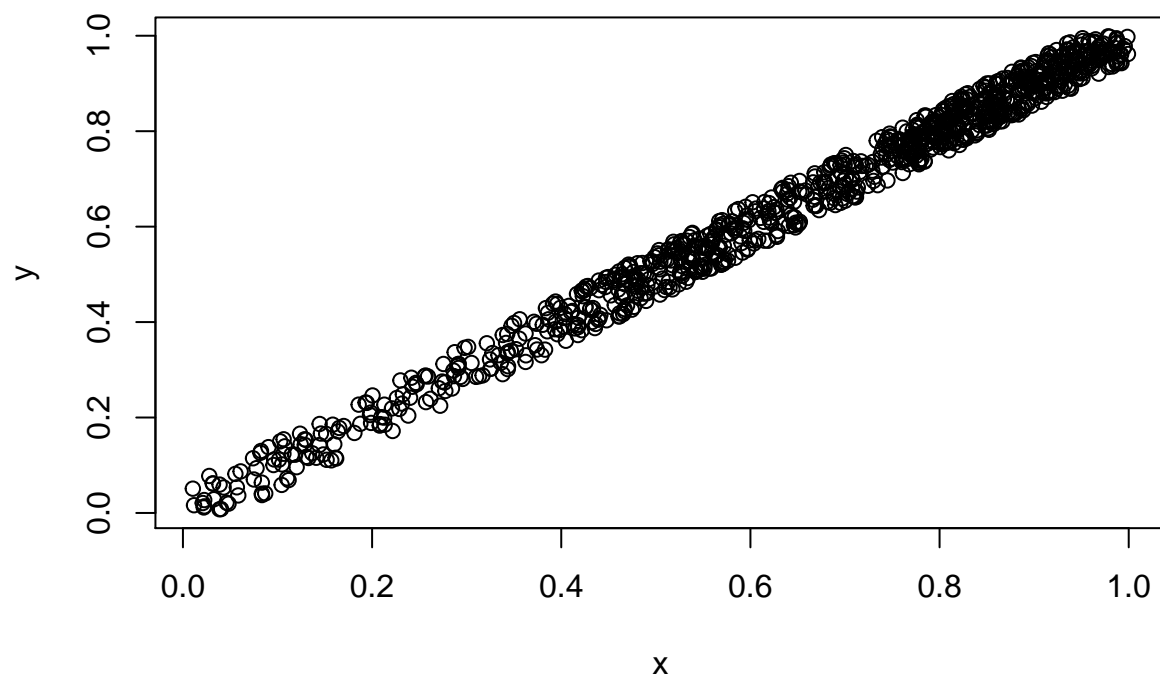


```
## NULL
```

```
when c= 0.05
```

```
GS(c[2])
```

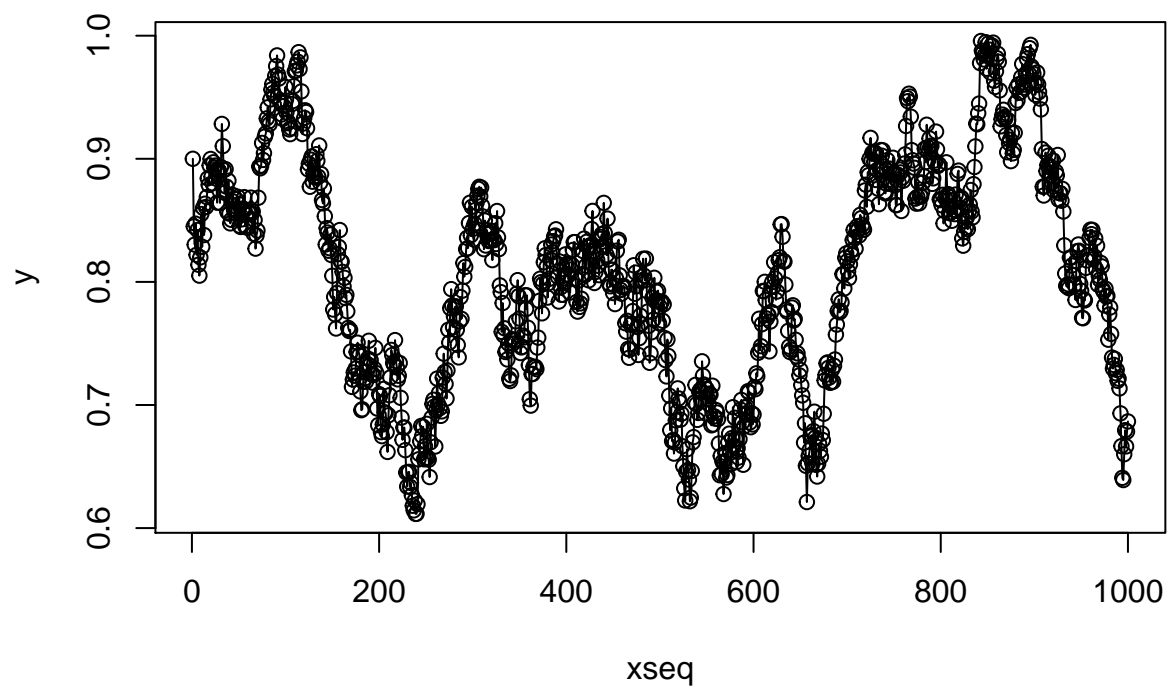
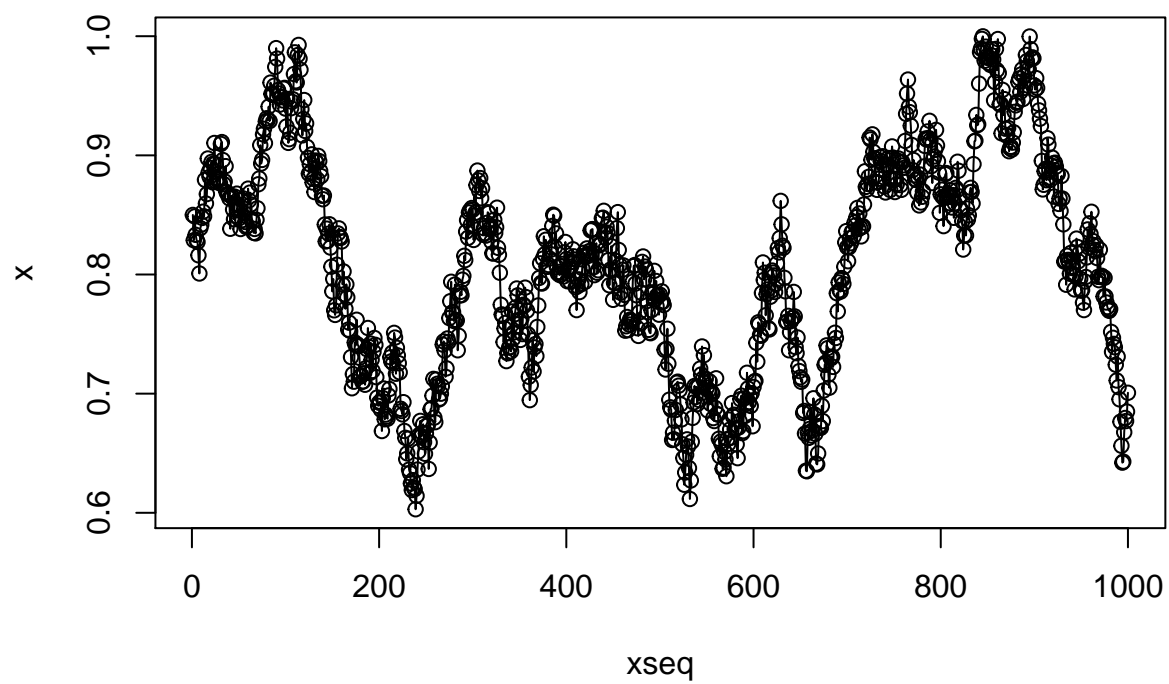


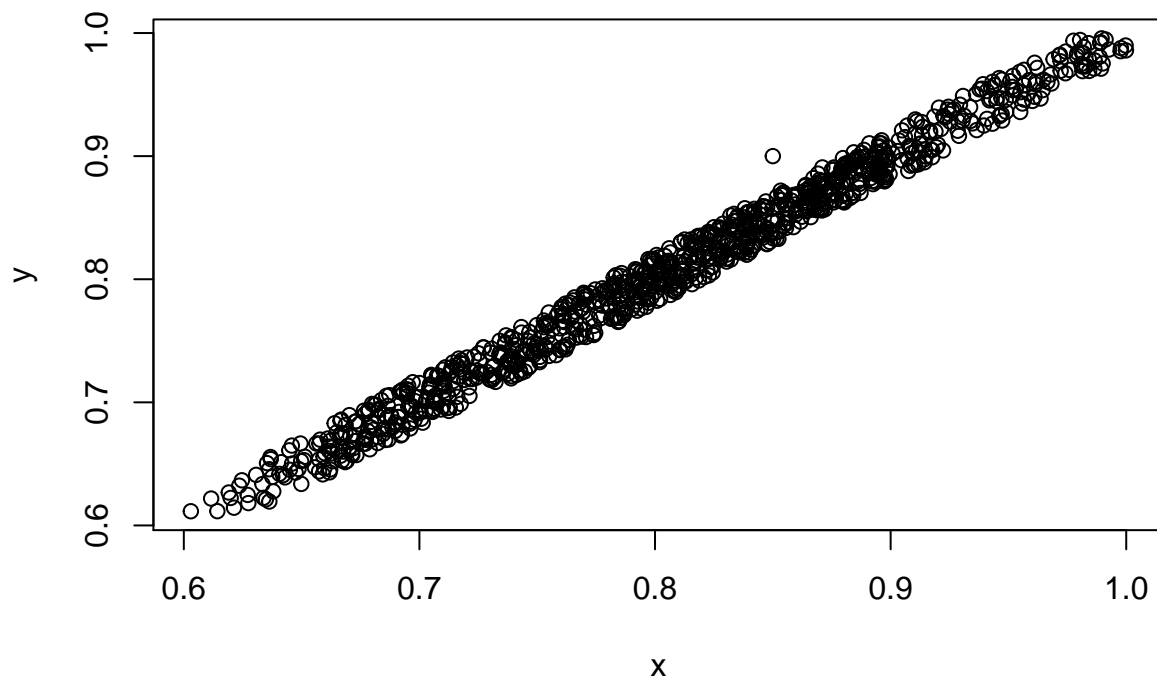


```
## NULL
```

when $c = 0.002$

```
GS(c[3])
```





NULL

Question d

Because when c is smaller, the sample will fluctuate and focus on certain areas, which is no longer a normal distribution.

Exercice 2

Question a

$$p(u|v) \sim \text{Uniform}(|v|, 1 - |v|)$$

$$p(v|u) \sim \text{Uniform}(-\min(u, c/2, 1 - u), \min(u, c/2, 1 - u))$$

##Question b

```
N <- 10^3

u<-rep(0,N)
v<-rep(0,N)
c<- c(0.25,0.05,0.02)

GS <- function(c){
```



```

u[1] <- 0.3
v[1] <- 0.2

for (i in 2:N){
  u[i] <- runif(1,abs(v[i-1]),1-abs(v[i-1]))
  v[i] <- runif(1,-min(u[i],c/2,1-u[i]),min(u,c/2,1-u))
}

xseq <-seq(1,N)
#traceplot of x
plot(xseq,u+v)
#traceplot of y
plot(xseq,u-v)

#scatterplot
plot(u+v,u-v)

return (NULL)
}

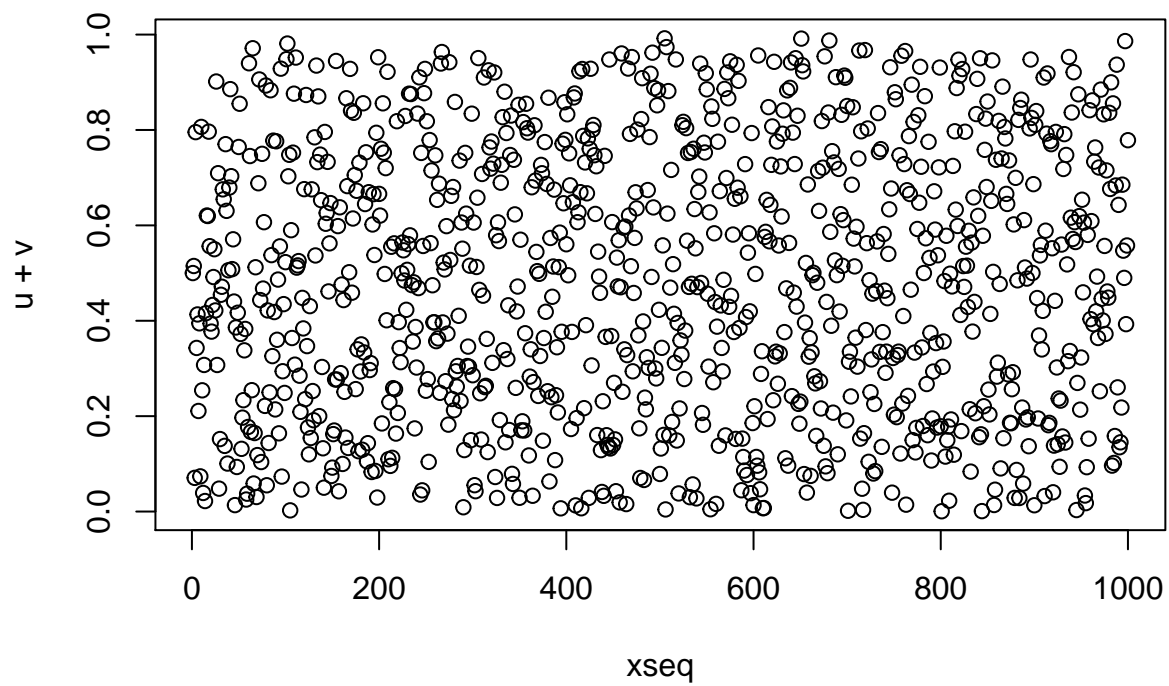
```

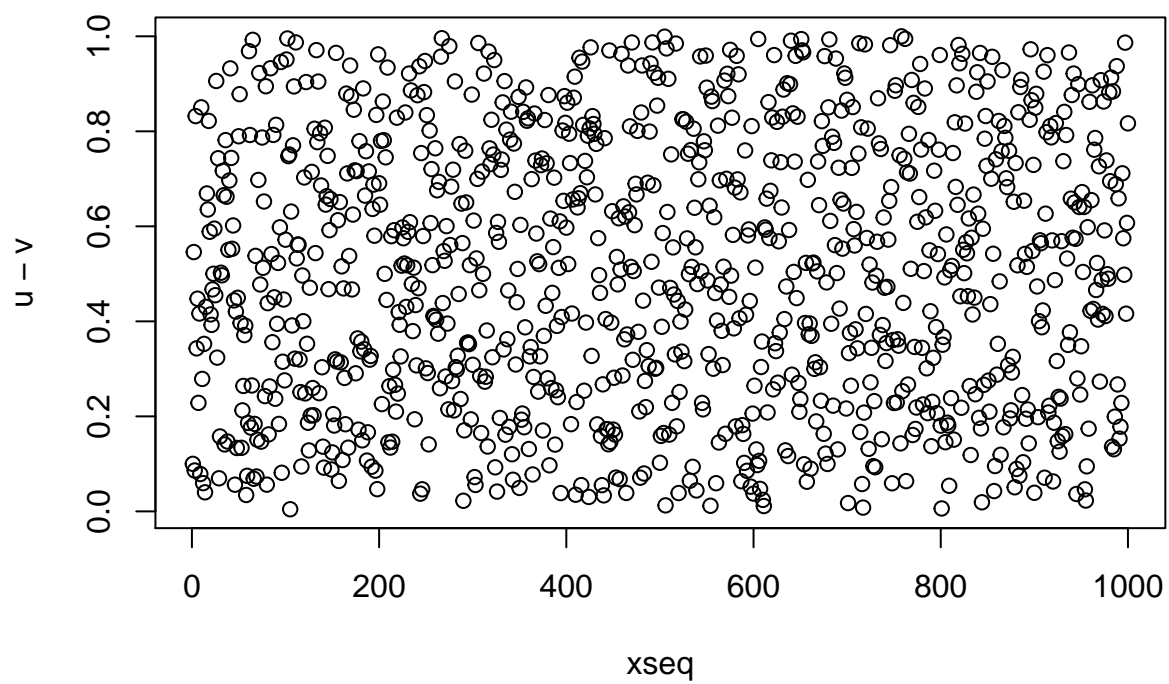
Question c

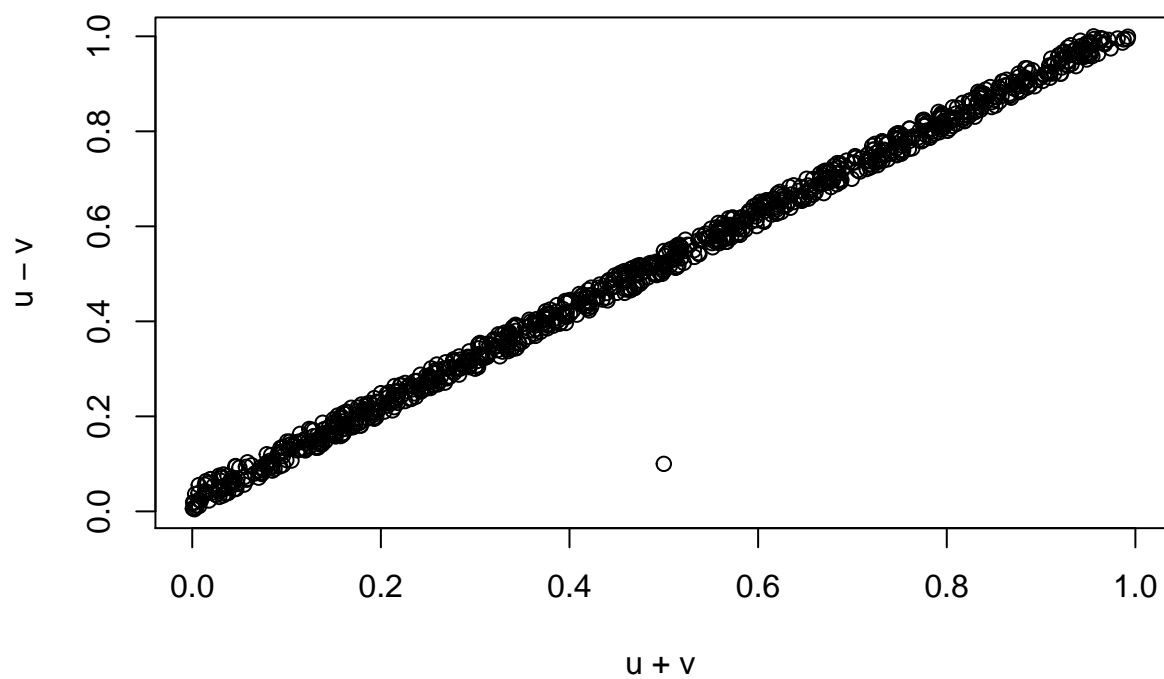
when $c = 0.25$

when $c = 0.05$

```
GS(c[2])
```



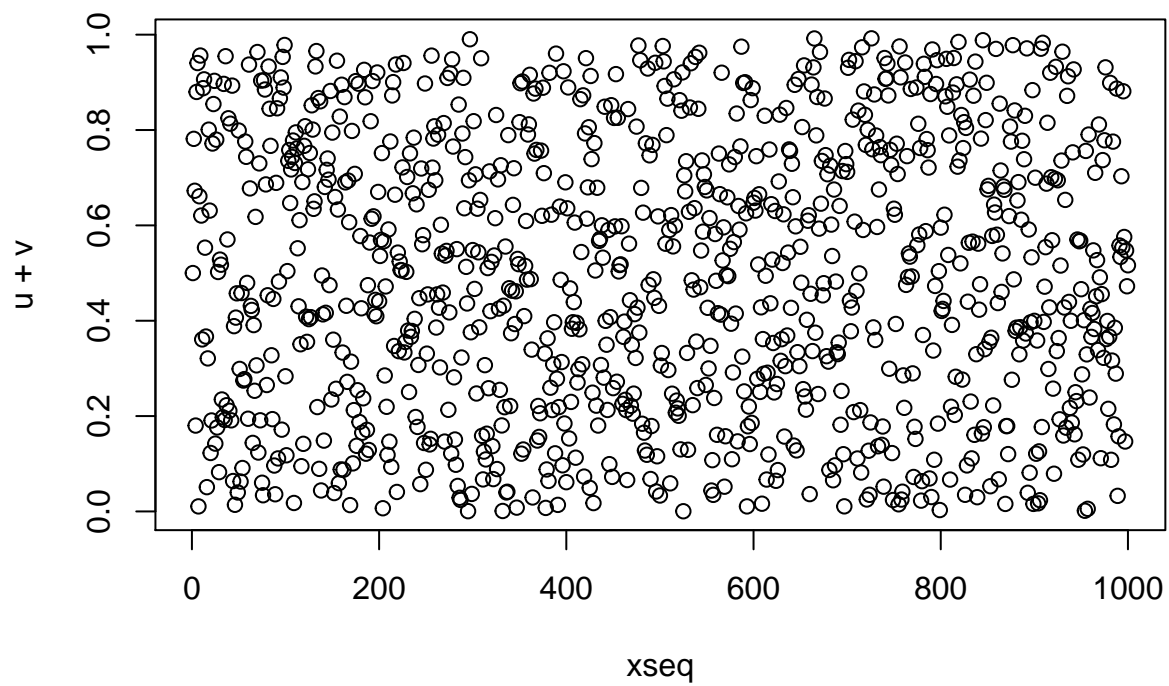


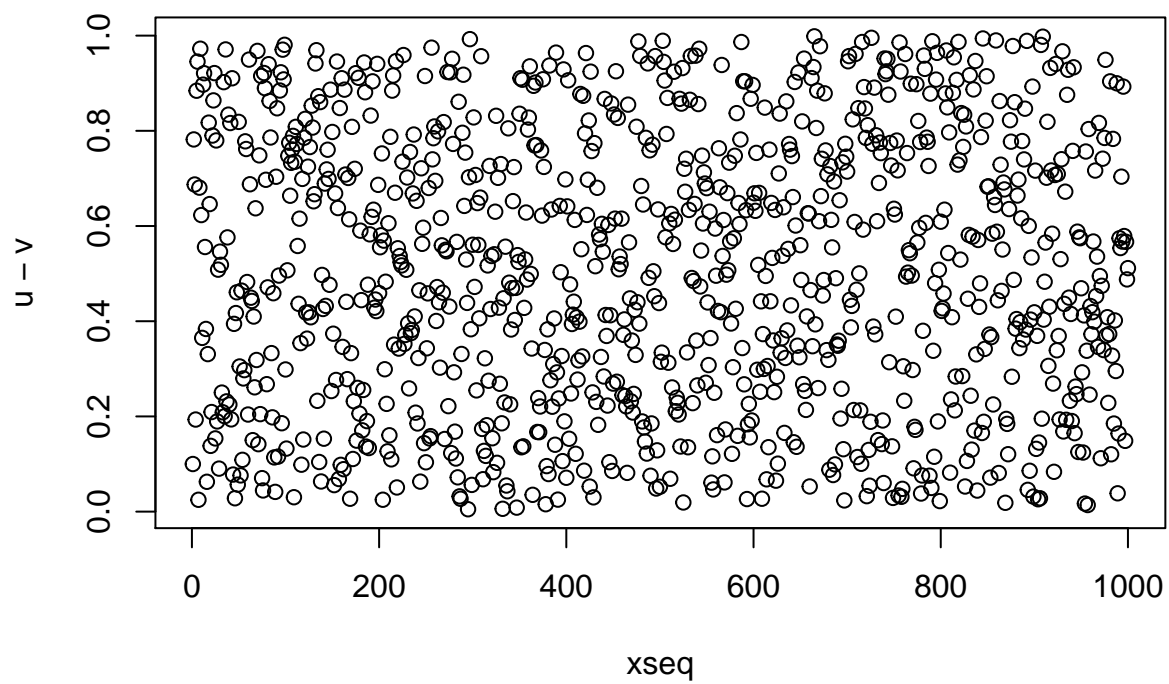


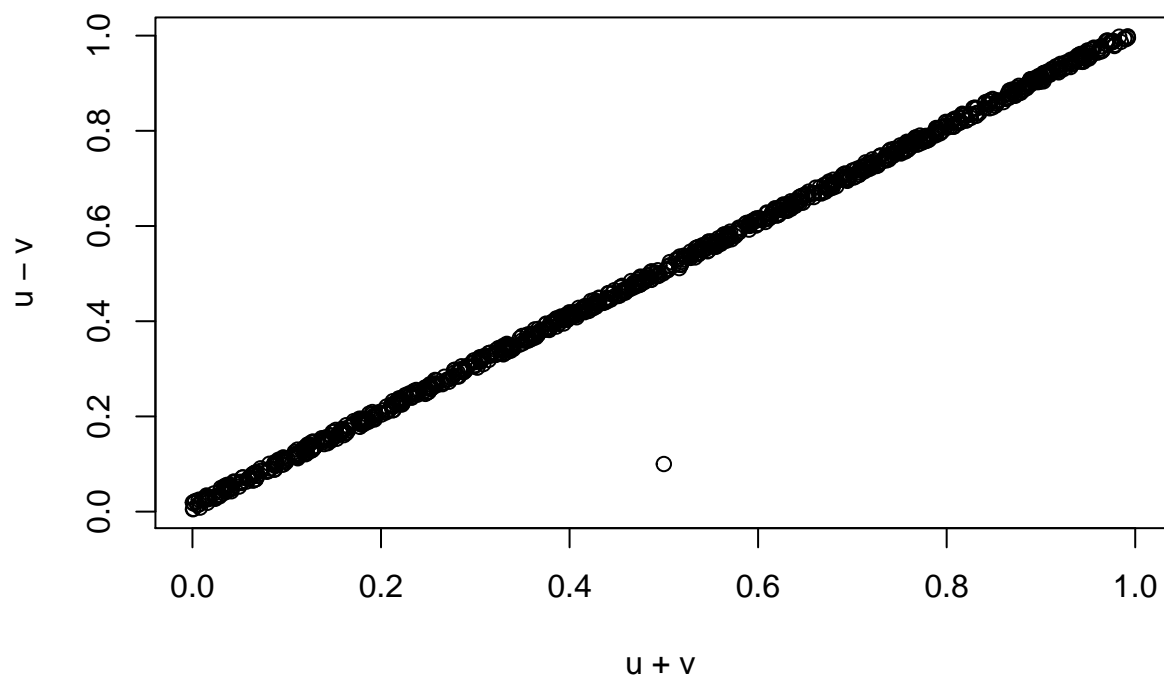
```
## NULL
```

when $c = 0.002$

```
GS(c[3])
```







NULL

Excercise 3

Question a

$$p(\beta|z) \sim N\left(\frac{\tau_{\beta}^2 z i x i}{1 + \tau}\right)$$

##Question b

Question c