A.T.S HW1

Joonwon Lee

2023-09-19

```
library(ggplot2)
library(gridExtra)
set.seed(500)
n = 600
half_n = n/2
w.list = rep(0, half_n+1)
X.list = rep(0, half_n+1)
for (j in 1:(half_n+1)){
  w.list[j] = 2*pi*(j-1)/n
}
```

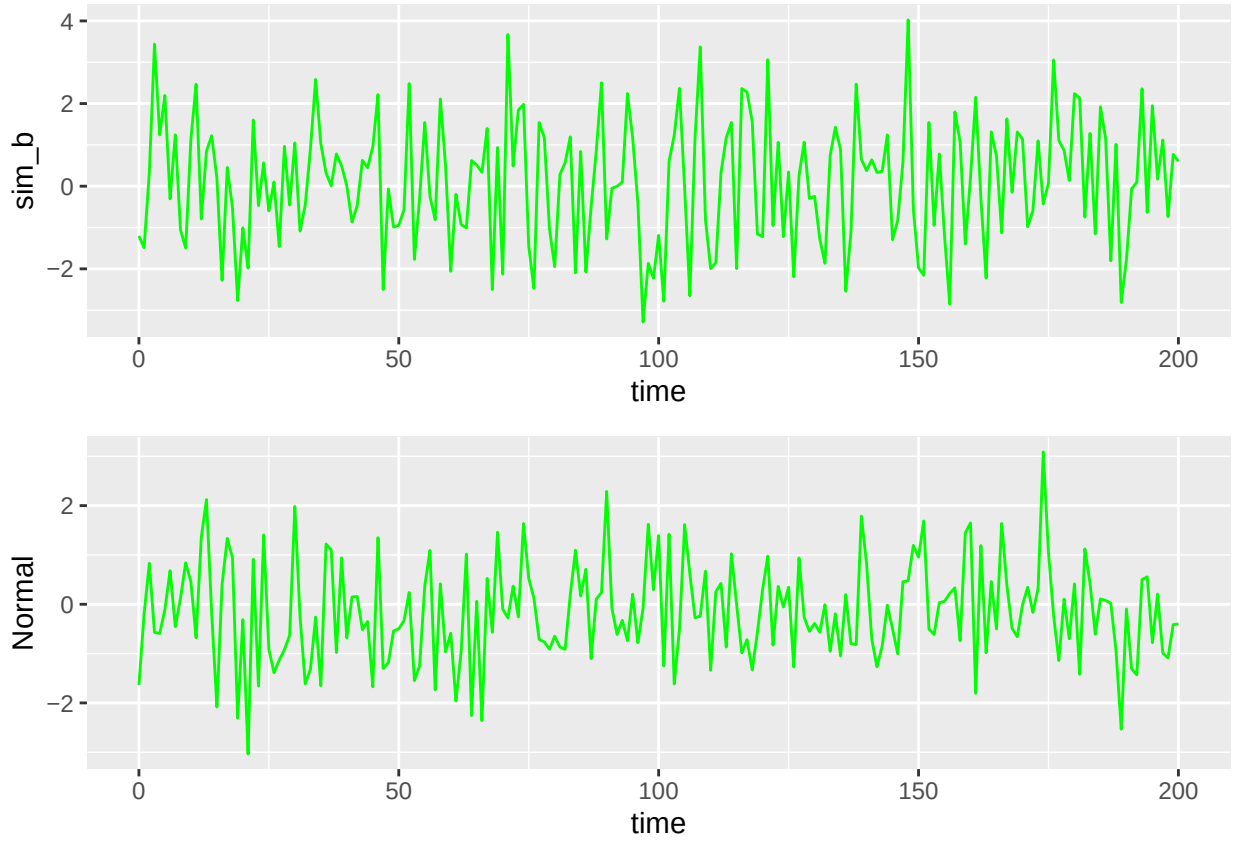
```
mysim = function(t){
  X.list[1] = rnorm(1,0,1)
  for (j in 2:(half_n)){
    Z1 = rnorm(1,0,2)
    Z2 = rnorm(1,0,2)
    X.list[j] = Z1*cos(w.list[j]*t) + Z2*sin(w.list[j]*t)
  }
  Z3 = rnorm(1,0,1)
  X.list[half_n+1] = Z3*(-1)^{t}
  X_t = 1/sqrt(n) * sum(X.list)
  return(X_t)
}
```

(b), (c) simulation plots

```
t.list= seq(0,200,1)
test.t = rep(0,201)
test.n = rep(0,201)
for(i in 1:201){
  test.t[i] = mysim(t.list[i])
  test.n[i] = rnorm(1,0,1)
}

df= data.frame(time=t.list, sim_b =test.t, Normal= test.n)
p1 = ggplot(data=df, mapping= aes(x=time , y=sim_b )) +
    geom_line ( color= "green")
p2 = ggplot(data=df, mapping= aes(x=time , y=Normal )) +
    geom_line ( color= "green")
```

```
grid.arrange(p1,p2, nrow=2)
```



(d) They look similar. By CLT, X_t converges to N(0,1) asymptotically.