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**Assignment 1**

**STT4110/6110**

1. Consider the simple linear filter with weights
2. = , where

,

.

)

1. If , t = 0, are independent random variables with mean 0 and variance and . Show that E=.

E ( = E

=

so that

= )

1. We use “WN” to indicate White noise. Consider

{} WN(0,)

{} WN(0,)

{} WN(0,)

1. Is { = {Explain

= E(

= E(

=

=

= E(

=

=

{, E(

if t>1, it results in a constant. Therefore, it is stationary

Cov(

=

=

=

=

Since it depends only on lag k, we can conclude saying that is stationary

1. Is { = {Explain

E( =E(( - 2(+ )) = E(+E(

=E(+E(

=E(-2E()+E()

= E(+E()+E(

= E(

For all values of t, { is constant. if t=1, we get E(

= 0+0

= which is constant

Only depends on time lag k, hence its stationary



1.3) Simulate a completely random process of length 48 with independent, normal values. Plot the time series plot. Does it look “random”? Repeat this exercise several times with a new simulation each time.

**R Script**

> a=rnorm(48)

> plot.ts(a,ylab="1 Random")

> a=rnorm(48)

> plot.ts(a,ylab="2 Random")

> a=rnorm(48)

> plot.ts(a,ylab="3 Random")

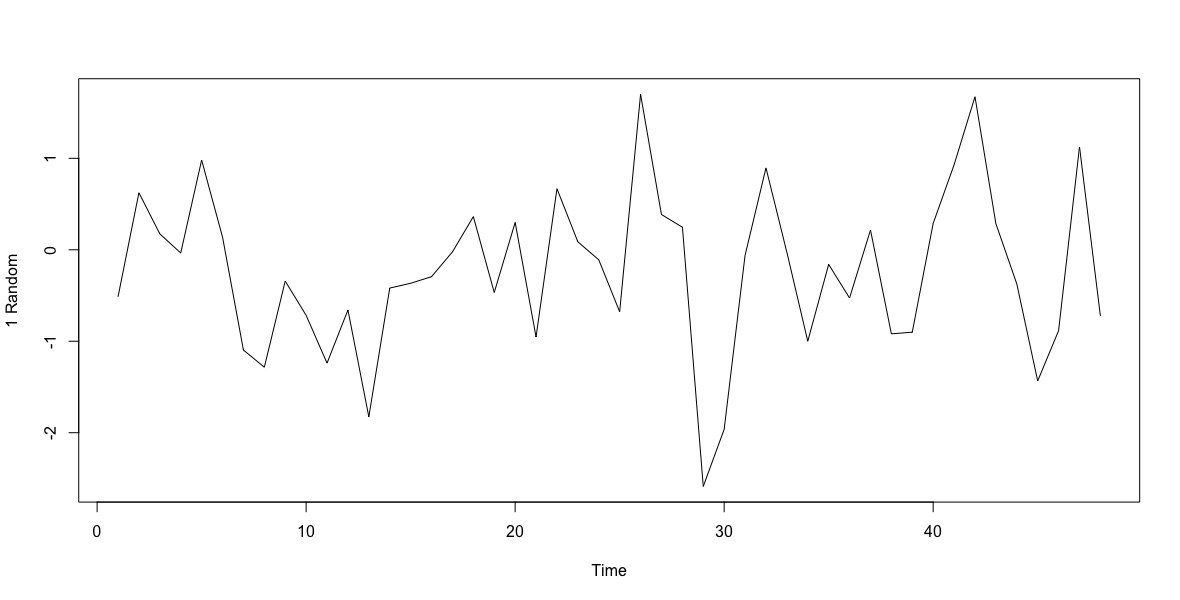
> a=rnorm(48)

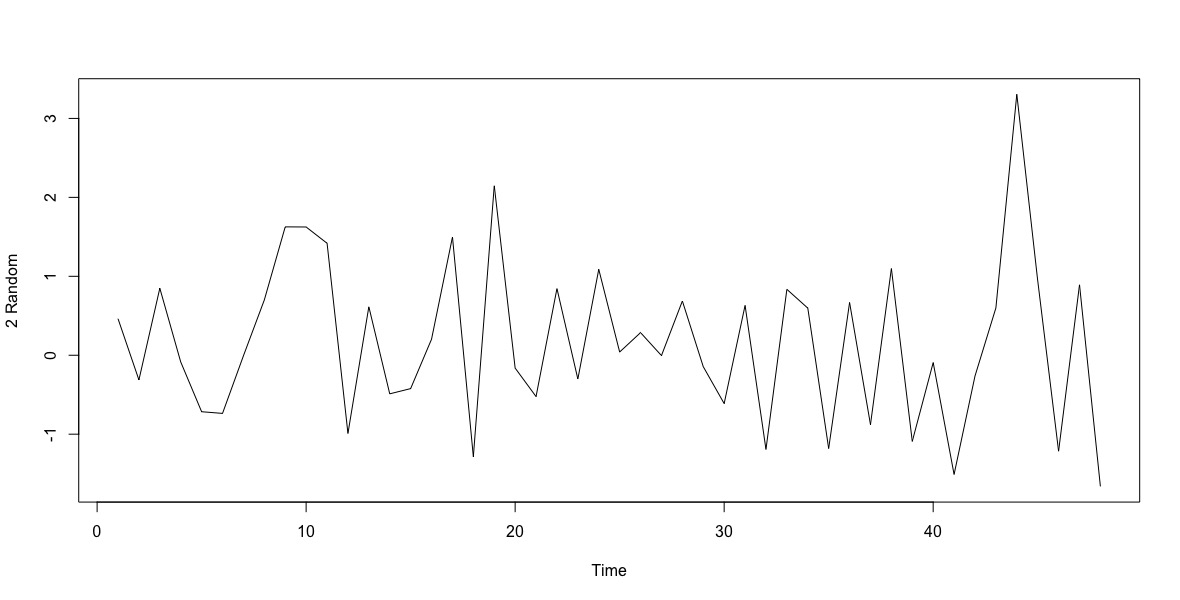
> plot.ts(a,ylab="4 Random")

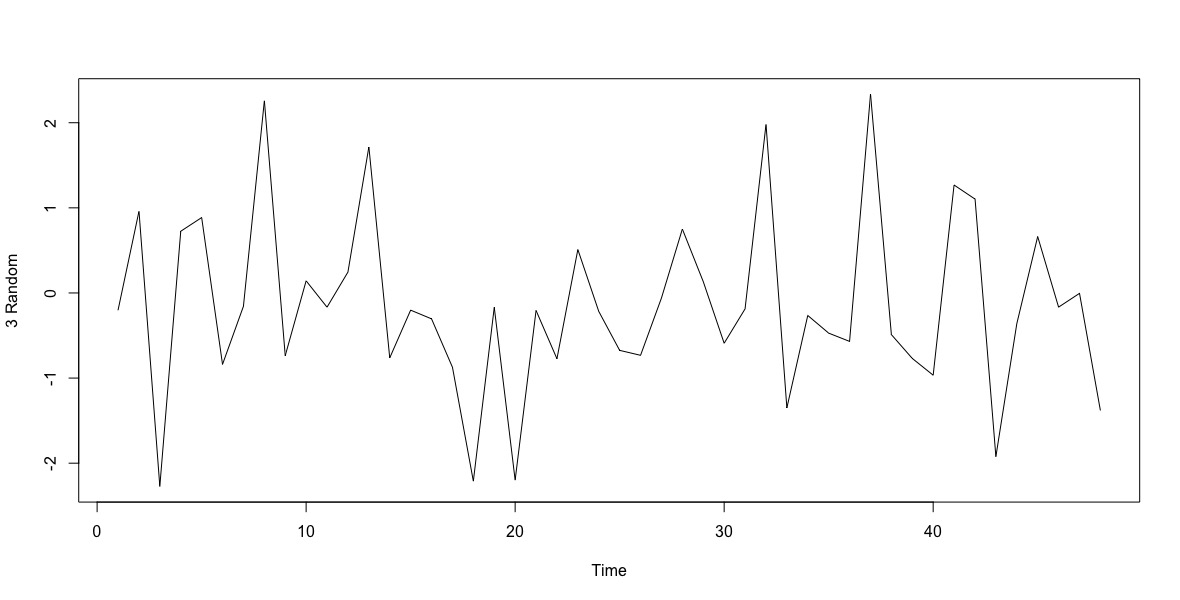
> a=rnorm(48)

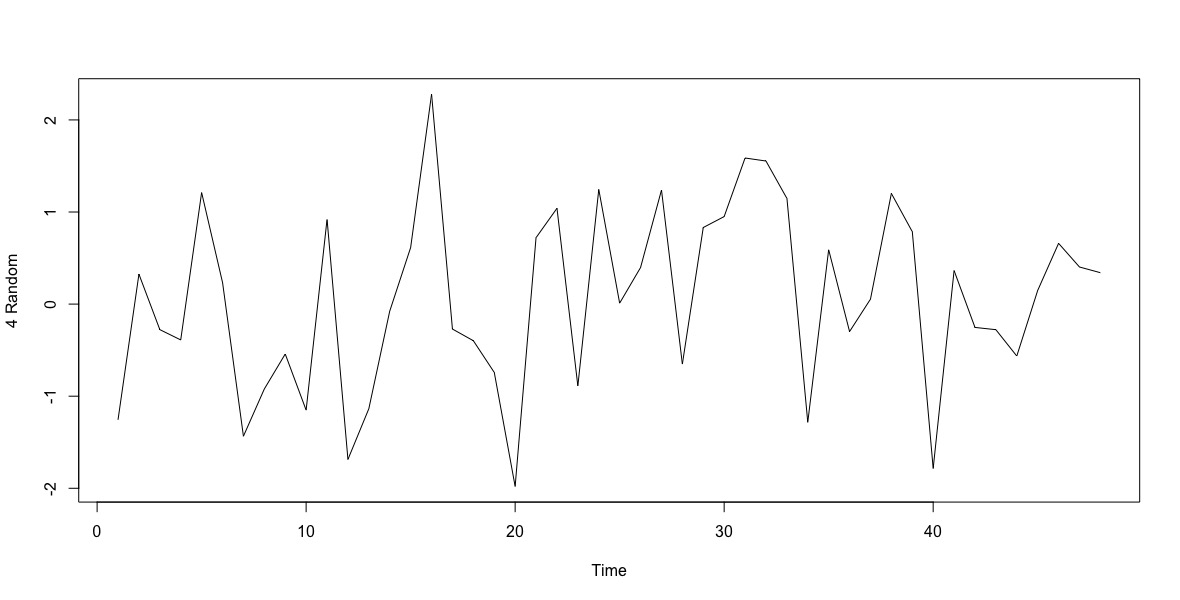
> plot.ts(a,ylab="5 Random")

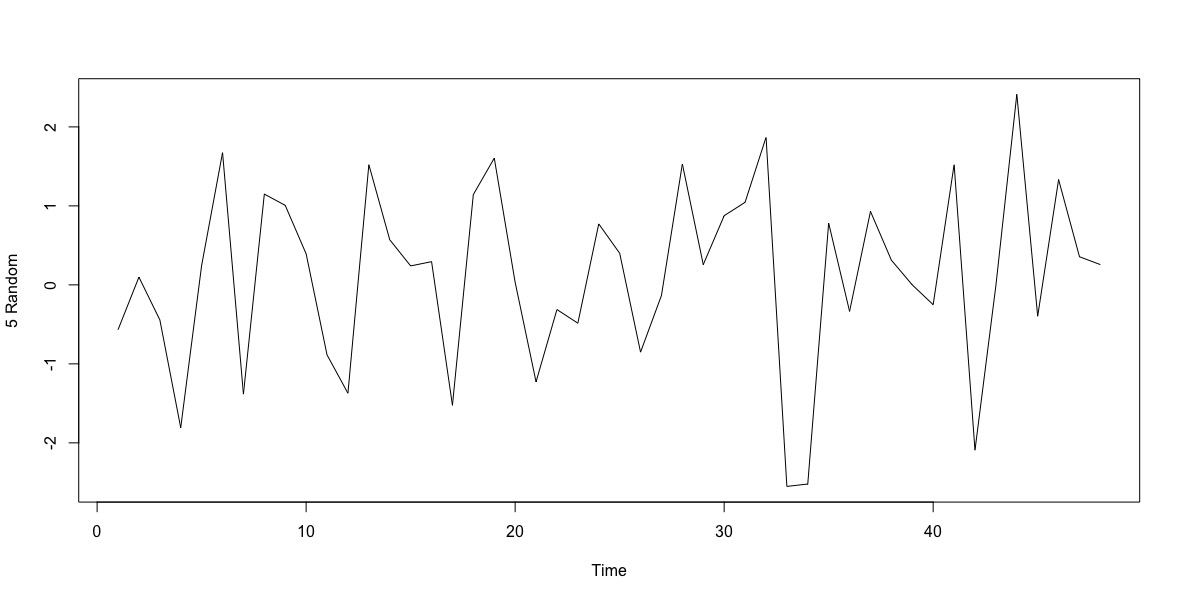
**Output**











From the plots, we can see that there is no visible pattern here.

1.4) Simulate a completely random process of length 48 with independent, chi-square distributed values, each with 2 degrees of freedom. Display the time series plot. Does it look “random” and non normal? Repeat this exercise several times with a new simulation each time.

**R Script**

> plot.ts(rchisq(48, 2),ylab="1 Random")

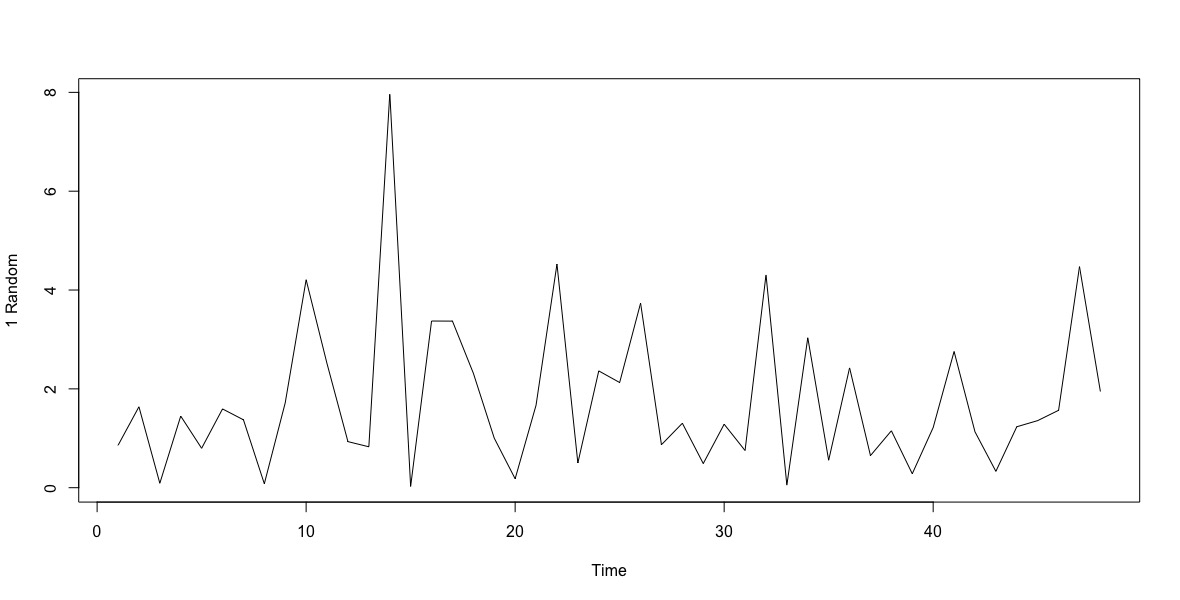
> plot.ts(rchisq(48, 2),ylab="2 Random")

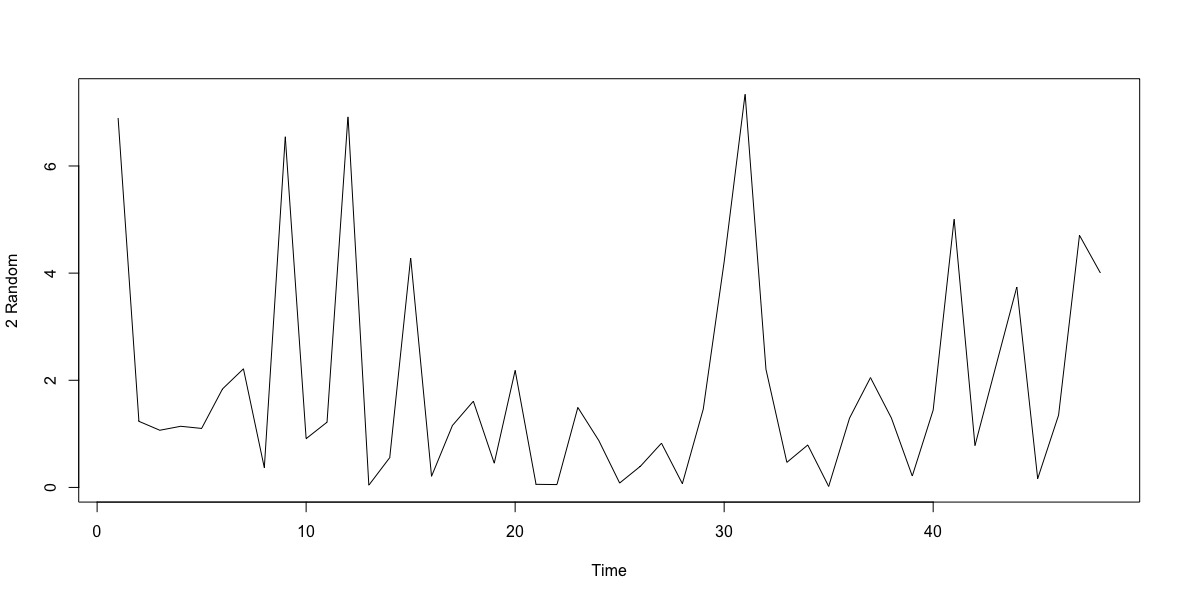
> plot.ts(rchisq(48, 2),ylab="3 Random")

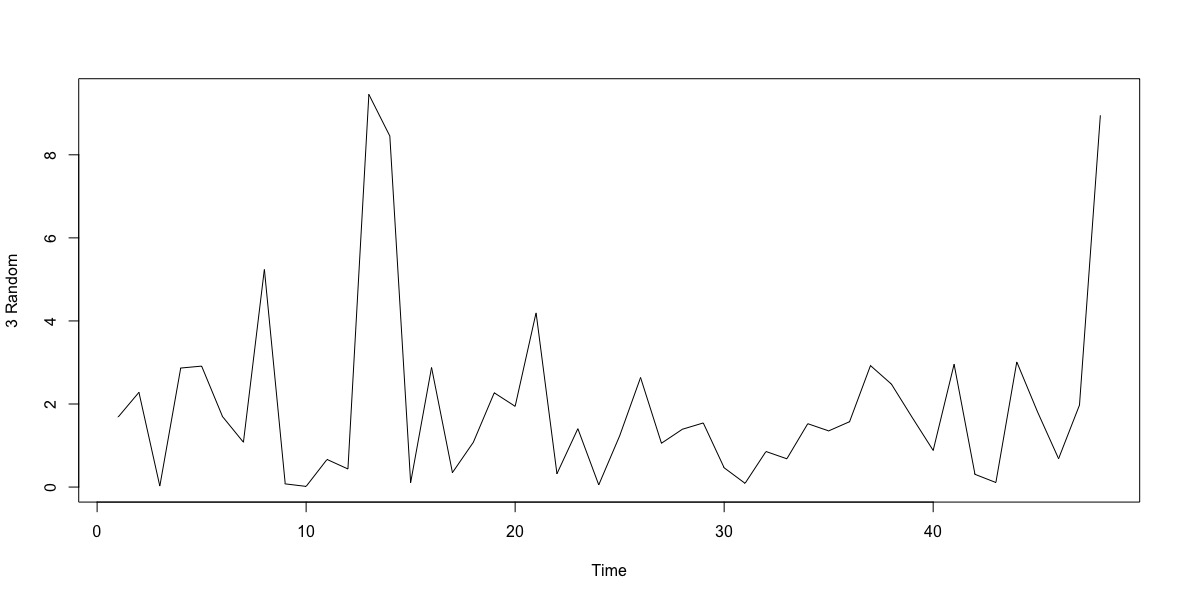
> plot.ts(rchisq(48, 2),ylab="4 Random")

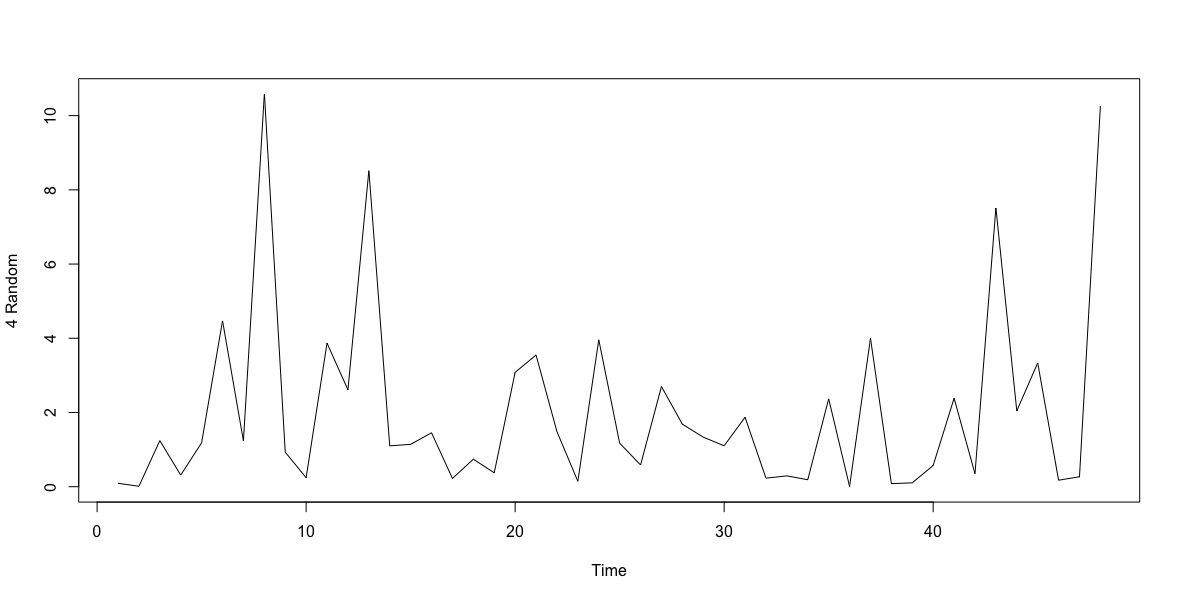
> plot.ts(rchisq(48, 2),ylab="5 Random")

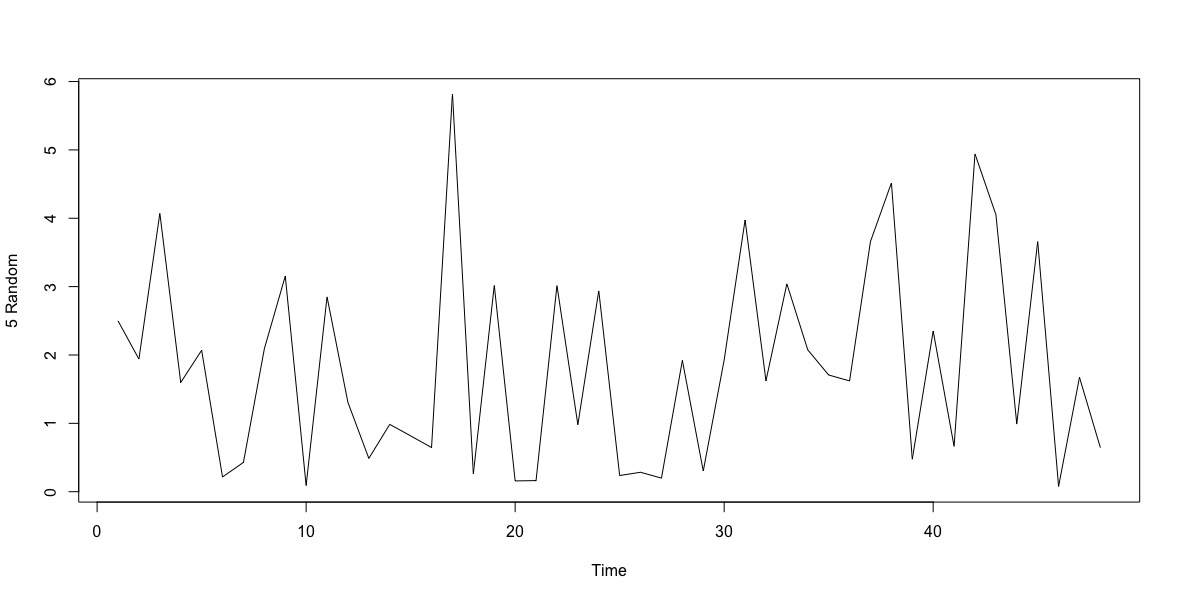
**Output**

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Though the process is non-normal, it appears to be random.

2.1) Suppose , , , , and

Find: (a)   
(b)   
(c)

= **16**

(b)

(c) =

(Linear property of covariance)

= **0.3953**

2.12) Suppose that . Show that {} is stationary and that, for , its   
autocorrelation function is nonzero only for lag .

)

independent of t

For = 0,