Forecasting Homework 6

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November 16, 2015

```
library('itsmr')
chaos1 = scan('http://people.stern.nyu.edu/churvich/Forecasting/Data/CHAOS1')
chaos2 = scan('http://people.stern.nyu.edu/churvich/Forecasting/Data/CHAOS2')
f = function(x){
  if(x<=0.6) return (x/0.6)
  else return ((1-x)/0.4)
}
```

1)

```
c(f(0.5),chaos1[1])
```

```
## [1] 0.8333333 0.8333330
```

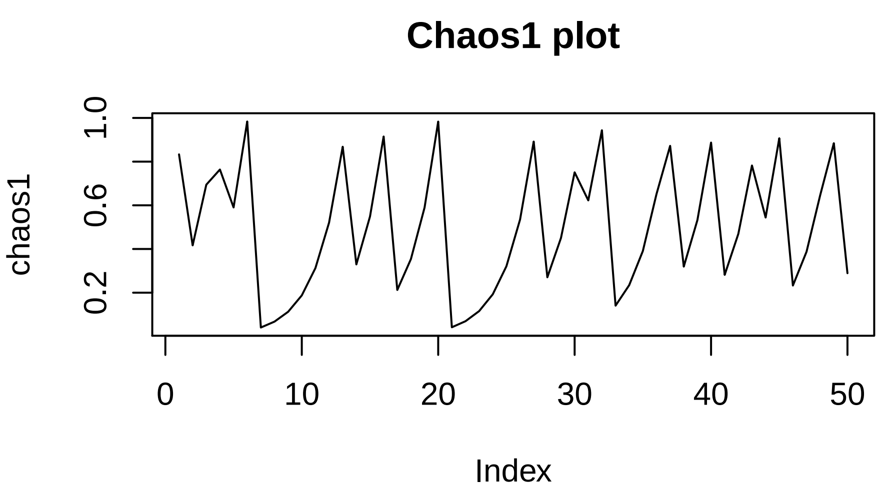
```
c(f(0.501),chaos2[1])
```

```
## [1] 0.835 0.835
```

We see that f(0.5) = x1 in chaos1 and f(0.501) = x1 in chaos2.

2)

```
plot(chaos1,type = 'l',main = 'Chaos1 plot')
```



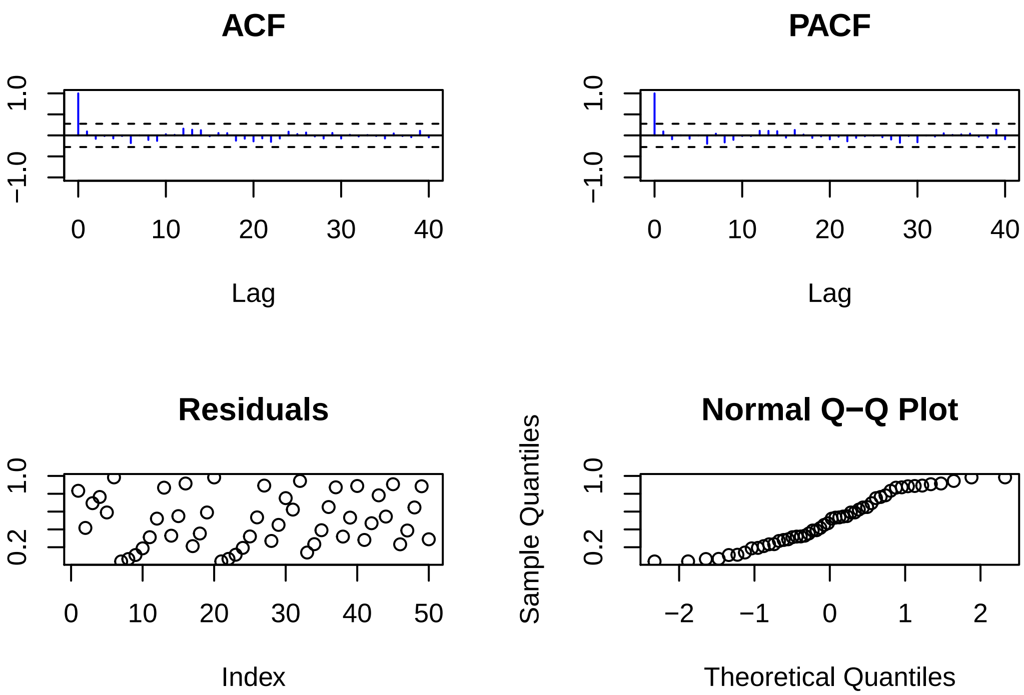
```r
plot(chaos2,type = 'l',main = 'Chaos2 plot')
```

The Chaos1 plot seems to be not random. There seems to be some periodicity with decreasing magnificence. The Chaos2 plot seems to be random. However, they are in fact not random, since they are generated recursively from a deterministic function. The series look sationary, because there is a clear mean-reverting.

3)

```r
test(chaos1)
```

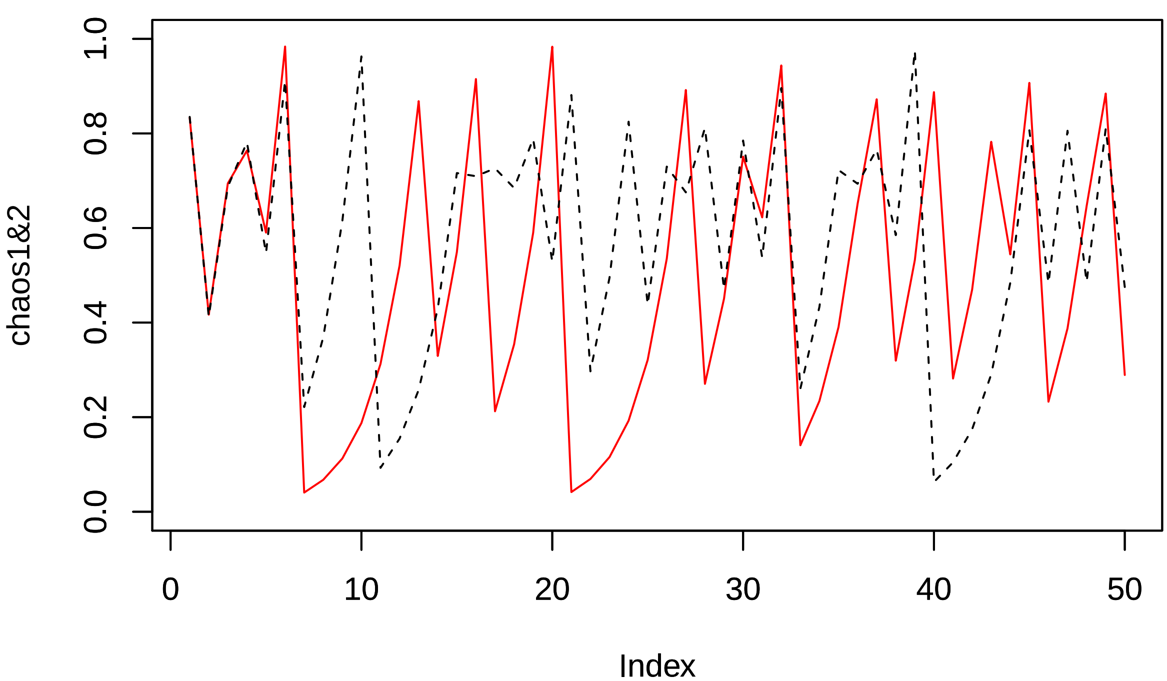
```
## Null hypothesis: Residuals are iid noise.
## Test                        Distribution Statistic   p-value
## Ljung-Box Q                Q ~ chisq(20)     13.18    0.8697
## McLeod-Li Q                Q ~ chisq(20)     10.37    0.9611
## Turning points T      (T-32)/2.9 ~ N(0,1)        26    0.0404 *
## Diff signs S        (S-24.5)/2.1 ~ N(0,1)        35         0 *
## Rank P            (P-612.5)/59.8 ~ N(0,1)       666    0.3708
```



The ACF and PACF of chaos1 shows that there is no lag outside the bar. Therefore the chaos1 can be modeled by white noise which is ARMA(0,0). ARMA(0,0) won't provide the best possible forecasts, it only gives the best linear forecast which is the mean of the series.

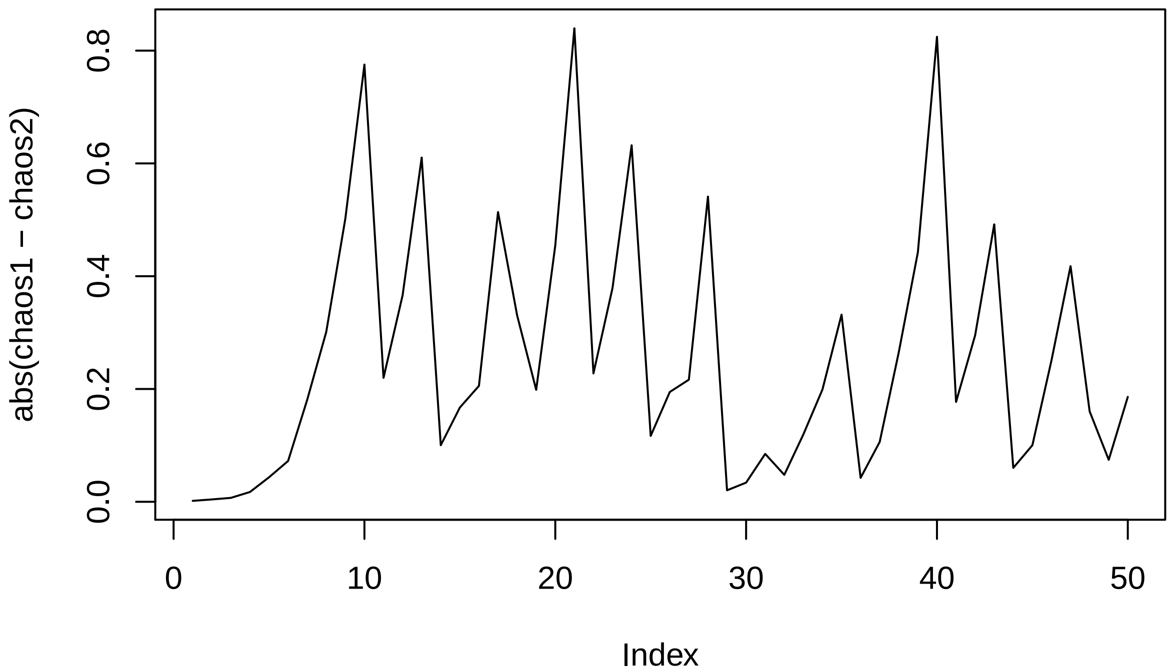
4)

```r
plot(chaos1,type = 'l',col = 'red',ylim=c(0,1),ylab = "");par(new = T)
plot(chaos2,type = 'l',ylim=c(0,1),lty =2,ylab = "chaos1&2" )
```



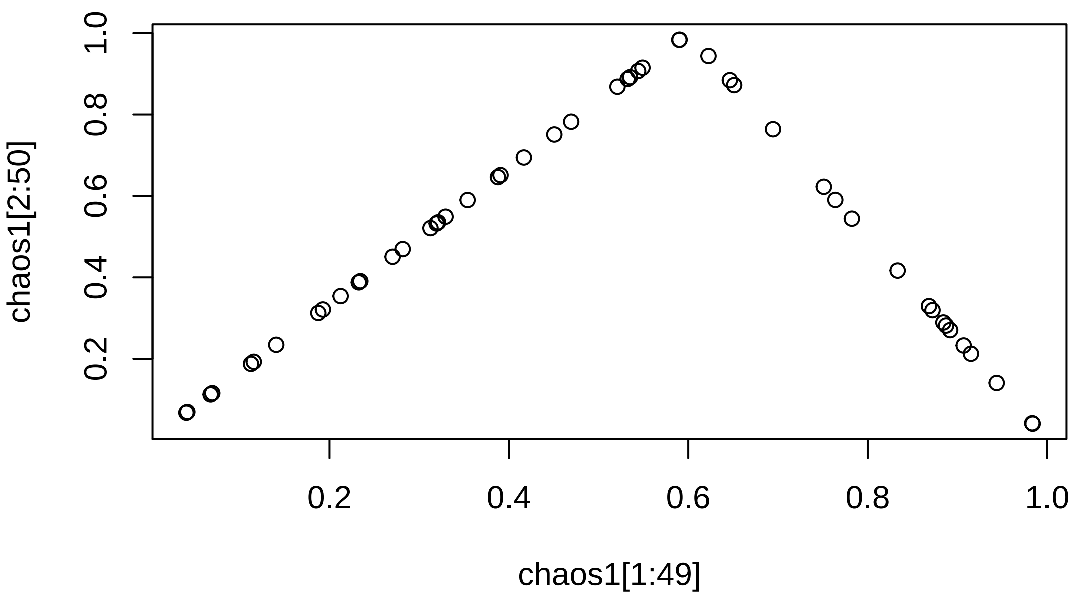
The Paths don't look similar. They should look similar when t is close to 1, because thet have vary close initial values. For t close to 1, the value generated by the same function will be similar. If chaos1 and chaos2 have close values at some lateter time i, their values would quickly diverge by some time after time i. From the plot, we see that the values are close at time 30. After a little time, they begin to diverge significantly.

```
plot(abs(chaos1-chaos2),type = 'l')
```



5)

```
plot(chaos1[1:49],chaos1[2:50])
```



The plot reveal the tent map. If we call chaos1[1:49] x, then f(x) = $\frac{1}{0.6}x$ if x $\leq$ 0.6, and f(x) = $\frac{1-x}{0.4}$ if x > 0.6.The function itself looks like a "tent". If X_t is AR(1), then the $x_2, ..., x_{50}$ versus $x_1, ..., x_{49}$ plot should be a straight line with slope 1. Therefore the plot helpes to see that X_t is not an AR(1) series.