

Time Series Modelling

NA

15-01-2022

B. Time series modelling

1. The figure labelled A to E show five series whose defining equations are given bellow.

i) $X_t - 2X_{t-1} + X_{t-2} = \epsilon_t - 0.4\epsilon_{t-1}$

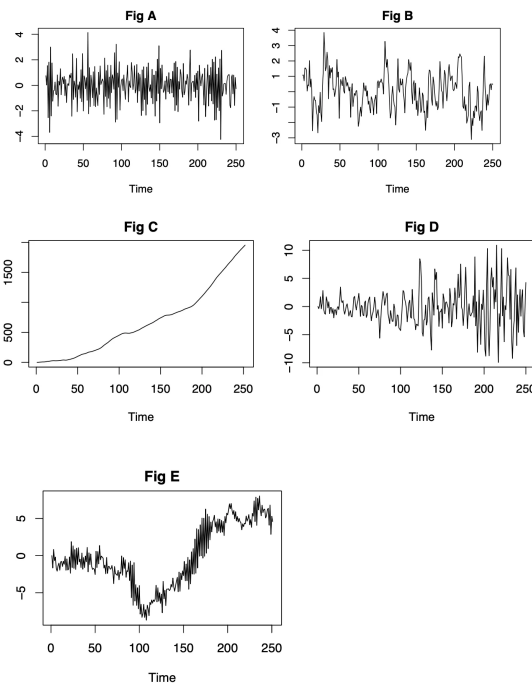
ii) $X_t = \epsilon_t + 0.02t\epsilon_{t-1}$

iii) $X_t = 0.65X_{t-1} + \epsilon_t$

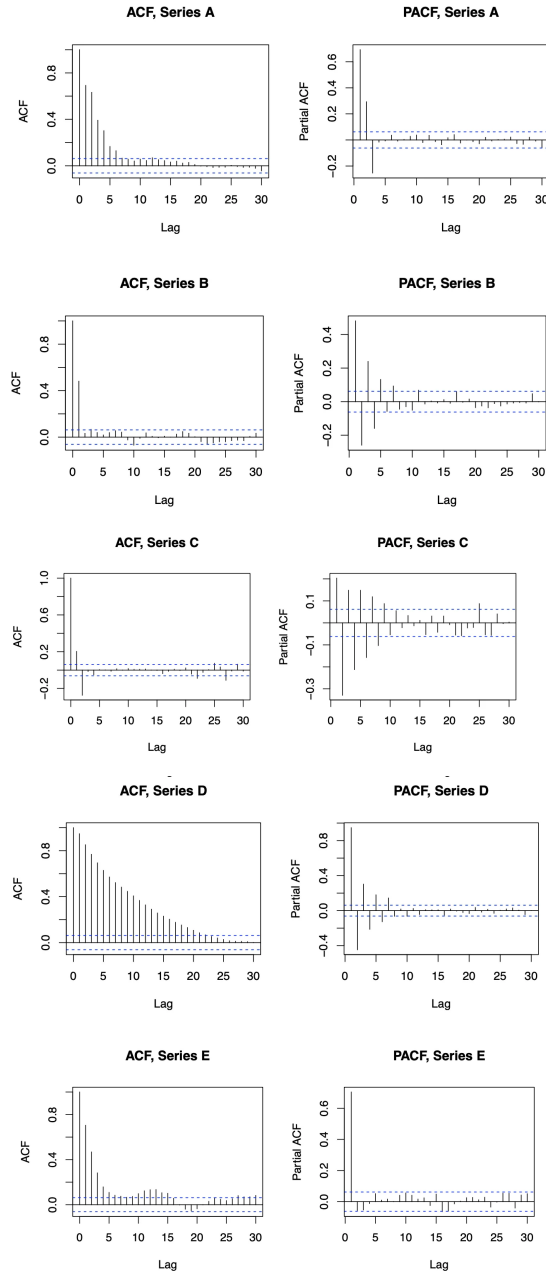
iv) $X_t = -0.65X_{t-1} + \epsilon_t$

v) $X_t = 0.1X_{t-1} + 0.9X_{t-2} + \epsilon_t$

State, with reasons, which equations corresponds to which plot.



2. Suggest appropriate ARMA models for the five (A,B,C,D,E) bellow, giving reasons for you choice in each case.



3. The data for this assignment are measured strength of the overturning in the North Atlantic from mooring at 26N between April 2014 and March 2015, found in the file `overturning.csv`
 - (a) Average the data in quarterly means. Produce numerical and graphical summaries of average data, and comment on your findings and highlight any potential outliers. You might find it useful to convert the averaged data to a time series
 - (b) Fit ARMA and an ARIMA model to the data. Choose the most appropriate model, and use this to predict the values for six 3-month periods from April 2014 to September 2015.
 - (c) Fit DLM to the data (including both a trend and seasonal component), Use your model to predict the values for April 2014 to September 2015.
 - (d) Compare results of parts b and c, and comment on any differences you may find.

Load data

```
dat<-read.csv("overturning.csv")
```

a)

We create quarterly time series

```
quarterly<-aggregate(dat[, "Overturning_Strength"],by=list(dat$Quarter,dat$year),FUN=mean)
quarterly_ts = ts(quarterly$x, start = c(2004, 2), frequency = 4)
```

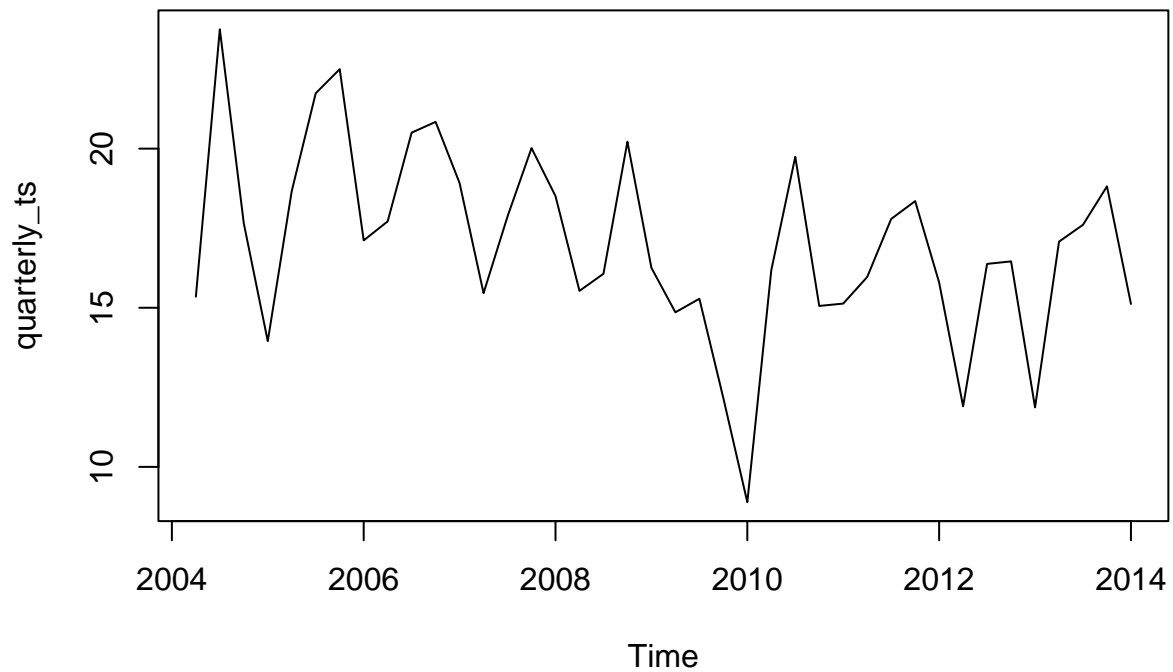
the numerical summary

```
summary(quarterly_ts)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	8.89	15.33	16.77	16.98	18.70	23.75

plot the the time series

```
plot(quarterly_ts)
```



we can see the value 8.89 is an outlier reached in the first quarter 2010.

b)

```
par(mfrow=c(1,2))
acf(quarterly_ts)
pacf(quarterly_ts)
```

