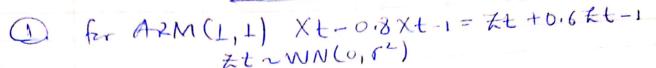
Home work #3.



al prove this process is causal 4 meetable. Xt-0.8 Xt-1 = Zt +0.6 Xt-1 ARMA(1,1).

then . the AR model. Creverating function.

(1-0.8xx+=(1+0.6x) Zt

thm. (1-0.84 = 1 cx)

1-6.8x=0 AR(1) -> x=1.25

1x1=1.25 > 1 so ARMA(1,1) D Causal

MR(1)

0'(x) = 1 + 0.6x.

1+0.6x=0

 $X = \frac{1}{0.6} = \frac{1.66}{1.66} > 1$

so ARMA(1,1) is muetible

. ARMA(I, I) is both muchble and Causal.

11 6) Compute coef. 41,42,43 in me equiv MAlor). Xt = 2 4; zt -1 me have ARMA(P,1): \$ (B)xt = O(B) Zt. J(B) & 4; Et-1 = 0(B) Xt. \$ (B) 4(B) \$ = 0 (B) \$. (B) + (B) = (B) -> re home . Xt-0.8/t-1 = Zt+0.6 xt-1 (1-0.8x) (1+4,x+42x2+ --) = 1+0.6x 1+(4,-0,8)x+(42-0,841)x2+142-0,842)xB = 1+0.6x 40 = 1. 4, = 0.8 +0.6 = 1.4. 42 = 0.841 = 0.2x44 = 1.12 43 = 0.8 42 = 0.8 x1.2 = 0.89 The DA ARMA (1,1) is equivalent MA(00)

The DM ARMA (1,1) is equivalent MA(00)

[Xt = 1+147+1.127+-1+0.894-2_

```
17 Pl
    iil compute coeff. 11,12,113. in ey AR(0)
                                              Xt = Z A; Xt-1
     me hane
                                              ARMA (P,g)
         OBIXt = O(B) Zt
                            from equivalent AR(00)
    DIBNE = O(B) 1(B) XE.
     (B) = O(B) A(B)
                                              given Xt-0.8xt-1 = At +0.6xt-1
     * 1-0.8x = (1+0.6x) (1+1,x+12x2+13x3+-)
    then
          = 1+(1,+0.6)x+(12+0.6)x2+(13+0.6/2)x3
                                              8
          11 =+ 0.6 = -0.8 => 11 = -1.4
          12 + 0.6/1=0 => 12 = 11.06=2[-1.4x0-6]
         13 + 0.6/2 =0 => 13 =- (0.6x0.84) =0.50
    The ARMA(1,1) equivalent AR(D)
    7t= (1+-1.4xt+0.84xt-1-0.5xt-2+-
```

Time series Homework Answers to Coding questions The codes and results are in notebook file

2. Number 2 is coding in a notebook

3.

(a) Perform order selection based on AIC and BIC and provided the choice of orders fromboth ICs (max p=4, max q=4). Do they agree in this case?

ANS--> Both AIC and BIC provided order selection of (1, 0). Yes their agree both at a min order (1,0).

(b) Perform order selection based on RMSE and MAE and cross validation(use the func-tions you have defined from question 2, and use 67% for split) provided the choice oforders. Do they agree?

ANS --> Best ARMA(1, 0) RMSE=0.976, Best ARMA(0, 4) MAE=0.782. Both MAE and MSE provided best orders at (0,4). So Yes They agree.

(c) Use a set of orders of your choice from part(a) as your model 1, estimate this ARMAprocess and write out the estimated ARMA equation using the summary table.

ANS --> My mean is 0.6001 and Then the ARMA(1,0) model is Xt = Xt = 0.6001+0.8673(Xt-1 - 0.6001) + Zt

(d) Use a set of orders of your choice from part(b) as your model 2, estimate this ARMAprocess and write out the estimated ARMA equation using the summary table.

ANS--> ARMA (0,4) Model: $X_t = 0.6818 + 0.9019Zt-1 + 0.8486Zt-2 + 0.5347Zt-3 + 0.2391Zt-4 + Zt$

(e) Plot forecast of 20 steps out of the given data using model 1 and model. Just by observing how the forecasting following the original data, which model do you think performed better? or they performed similarly?

ANS --> Model 1 predicted from AIC and BIC seems to perform better since the observed data and the forecast are going close tat each step(the estimation is pretty close to the observed data). In the second model which was based on the RMSE and MAE there is some difference in the forecast and the observed data.

(f) We have defined the function to use one-step rolling cross validation. Read it very carefully and define function(s) in python to evaluate ARMA performance by usingh=2, 3 and 4 steps rolling cross validation(you don't have to follow how I did it), andreport the RSME of 1-step, 2-step, 3-step and 4-step forecasting for model 1 and model2:RMSE1-step2-step3-step4-stepModel 1Model 2

Model 1

ARMA(1, 0), Step=1, RMSE=0.988 ARMA(1, 0), Step=2, RMSE=0.989 ARMA(1, 0), Step=3, RMSE=1.020 ARMA(1, 0), Step=4, RMSE=1.069

Model 2

ARMA(0, 4), Step=1, RMSE=0.976 ARMA(0, 4), Step=2, RMSE=1.859 ARMA(0, 4), Step=3, RMSE=1.859 ARMA(0, 4), Step=4, RMSE=1.859