Practice Problems 1

Question 1. Explain the concepts of point forecast, interval forecast, density forecast.

See slides 27 and 28 in lec01_02slides.pdf.

Question 2. Define first order and second order weakly stationary processes.

See slide 16 in lec05slides.pdf.

Question 3. Define white noise.

See slide 3 in lec07slides.pdf.

Question 4. Explain what loss function is.

See slides 19 to 23 in lec06slides.pdf.

Question 5. Give two examples of loss function, one symmetric, one asymmetric.

See slides 24 an 25 in lec06slides.pdf.

Question 6. Consider Fed forecasting inflation. Is it likely to have (1) a symmetric loss function, or (2) an asymmetric loss function with larger losses for negative forecast errors, or (3) an asymmetric loss function with larger losses for positive forecast errors? Explain.

See HW3 part (g) hw03sol.pdf.

Question 7. Consider Congressional Budget Office producing forecasts of future budget deficits. Is it likely to have a symmetric loss function or are the relative costs of over- and under-predicting public deficits different, and the loss function is thus asymmetric? Explain.

Question 8. Explain how increasing ϕ_1 in an AR(1) model changes the behavior of time series Y_t.

See slides 6 to 10 in lec09slides.pdf.

Question 9. Define an AR(2) model and describe how its AC and PAC functions look like.

See slides 13 to 15 in lec09slides.pdf.

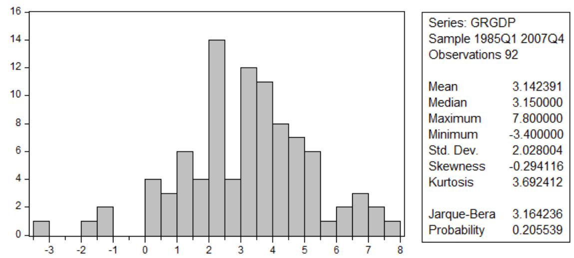
Question 10. Define an MA(4) model and describe how its AC and PAC functions look like.

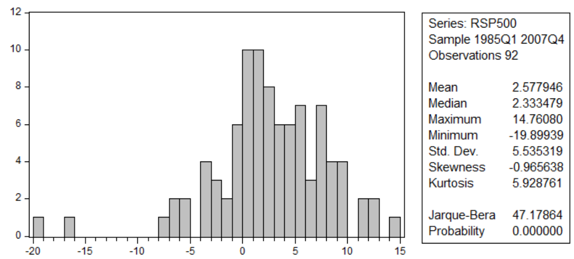
See slides 8 and 31 in lec07slides.pdf and slides 9 and 10 in lec10slides.pdf.

Question 11. Explain the role of the adjusted R^2, AIC and SIC, in model selection.

See slide 15 in lec10slides.pdf.

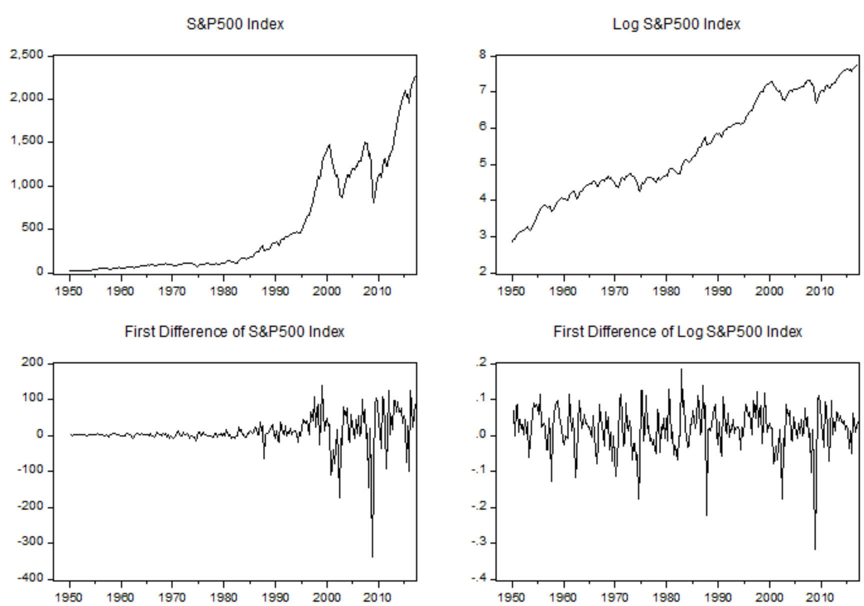
Question 14. Figure below shows the histograms for the real GDP growth rate and the quarterly return for S&P500 Index during the period 1985Q1-2007Q4. Is the GDP growth rate normally distributed in this sample? How about the returns for S&P500 Index?





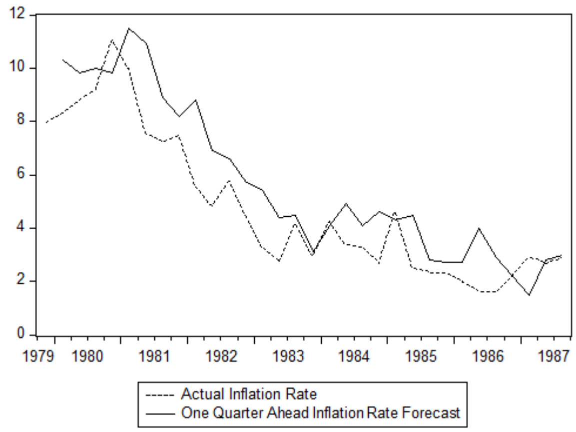
See HW1 part (c) hw01sol.pdf.

Question 15. Figure below shows the time series for the S&P500 Index, the log transformed S&P500 Index, and also their first differences. Explain which of the four series are nonstationary, first order weakly stationary, second order weakly stationary.

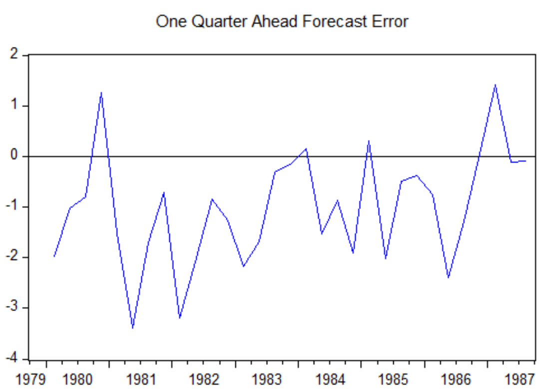


See slides 19 and 20 in lec05slides.pdf for a very similar example with Dow Jones Index.

Question 16. Consider the Fed's one quarter ahead forecast for inflation during the 1979Q4-1987Q3 period.



Suppose that we want to test whether the Fed's forecast are optimal under the symmetric quadratic loss function, which would imply that $E(y_{t+1}) = f_{t,1}$ and thus the forecast error $e_{t,1} = y_{t+1} - f_{t,1}$ would have to satify $E(e_{t,1}) = 0$. In other words, if the Fed's forecast are optimal under the symmetric quadratic loss function, the forecast error $e_{t,1}$ should fluctuate around zero, have zero mean, and in the regression $e_{t,1} = \beta_0 + e_t$ coefficient β_0 should be zero. Figure below shows that time series plot for the forecast errors, and the results of that regression. Interpret these results; what can we say about Fed's loss function during 1979Q4-1987Q3 based on them?



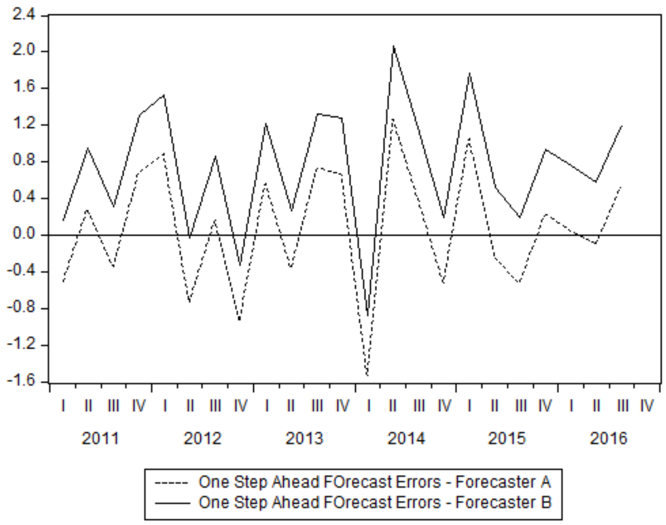
Dependent Variable: GPGDP_E1
Method: Least Squares
Date: 02/24/17 Time: 19:34
Sample (adjusted): 1980Q1 1987Q3
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.017073	0.202722	-5.017080	0.0000

R-squared	0.000000	Mean dependent var	-1.017073
Adjusted R-squared	0.000000	S.D. dependent var	1.128708
S.E. of regression	1.128708	Akaike info criterion	3.111751
Sum squared resid	38.21948	Schwarz criterion	3.158009
Log likelihood	-47.23215	Hannan-Quinn criter.	3.126830
Durbin-Watson stat	1.562466		

See HW3 parts (b), (d) and (g) in hw03sol.pdf.

Question 17. Consider two forecasters, A and B, who use the same AR model to forecast the real GDP growth rate during 2011Q1-2016Q4, but produce different forecasts, $f_{t,1}^{(A)} = \mu_{t+1|t}$ and $f_{t,1}^{(B)} = \mu_{t+1|t} - \sigma_{t+1|t}^2$, where $\mu_{t+1|t} = E(y_{t+1}|I_t)$ is the conditional mean, $\sigma_{t+1|t}^2 = var(y_{t+1}|I_t)$ the conditional variance. The forecast errors are thus $e_{t,1}^{(A)} = y_{t+1} - \mu_{t+1|t}$ and $e_{t,1}^{(A)} = y_{t+1} - \mu_{t+1|t} + \sigma_{t+1|t}^2$ shown below. Based the forecasts they choose and their forecasting errors, what can we say about the loss functions of these two forecasters - are they symmetric or asymmetric?



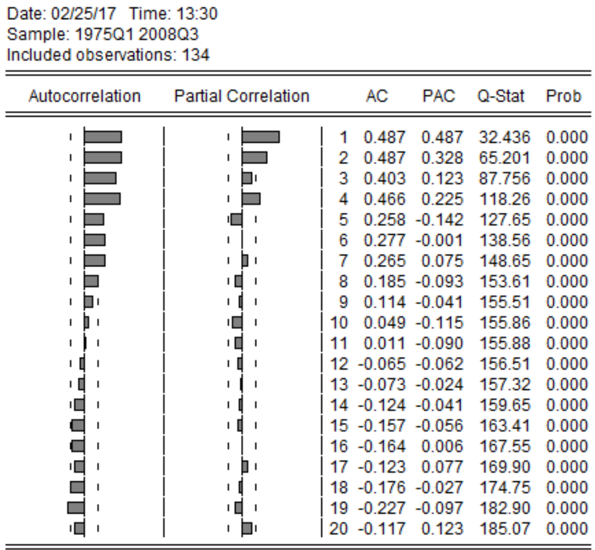
Forecaster A: the forecast is the conditional mean, which is optimal under symmetric quadratic loss function, and the forecast errors are on average zero.

See slide 29 in lec06slides.pdf.

Forecaster B: the forecast is biased, since conditional variance is subtracted from the conditional mean, this is optimal under asymmetric linex loss function. Forecasts in this case tend to underpredict actual values and the forecast errors are on average positive.

See slide 30 in lec06slides.pdf.

Question 18. Figure below show the correlogram for the percentage change in the house price index in San Diego MSA during 1975Q1-2008Q3. Discuss which AR/MA/ARMA models would you consider as plausible candidates for this time series and explain why.



Date: 02/25/17 Time: 13:30
Sample: 1975Q1 2008Q3
Included observations: 134

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.487	0.487	32.436	0.000
		2	0.487	0.328	65.201	0.000
		3	0.403	0.123	87.756	0.000
		4	0.466	0.225	118.26	0.000
		5	0.258	-0.142	127.65	0.000
		6	0.277	-0.001	138.56	0.000
		7	0.265	0.075	148.65	0.000
		8	0.185	-0.093	153.61	0.000
		9	0.114	-0.041	155.51	0.000
		10	0.049	-0.115	155.86	0.000
		11	0.011	-0.090	155.88	0.000
		12	-0.065	-0.062	156.51	0.000
		13	-0.073	-0.024	157.32	0.000
		14	-0.124	-0.041	159.65	0.000
		15	-0.157	-0.056	163.41	0.000
		16	-0.164	0.006	167.55	0.000
		17	-0.123	0.077	169.90	0.000
		18	-0.176	-0.027	174.75	0.000
		19	-0.227	-0.097	182.90	0.000
		20	-0.117	0.123	185.07	0.000

See slides 7 to 10 in lec10slides.pdf.

Question 19. Figure below shows the correlogram for the residuals from AR(2) and AR(4) models for the percentage change in the house price index in San Diego MSA. For a good model, the residuals should be white noise with no time dependence. Do the residuals from AR(2) and AR(4) model satisfy this property?

Date: 02/25/17 Time: 13:32
Sample: 1975Q1 2008Q3
Included observations: 134
residuals from AR(2) model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.060	-0.060	0.4987	
		2	-0.157	-0.162	3.9233	
		3	0.081	0.062	4.8320	0.028
		4	0.272	0.265	15.227	0.000
		5	-0.106	-0.053	16.821	0.001
		6	0.002	0.065	16.822	0.002
		7	0.161	0.116	20.544	0.001
		8	0.061	0.030	21.086	0.002
		9	-0.004	0.080	21.089	0.004
		10	-0.001	-0.028	21.089	0.007
		11	0.022	-0.047	21.158	0.012
		12	-0.054	-0.078	21.599	0.017
		13	0.005	-0.036	21.602	0.028
		14	-0.033	-0.068	21.765	0.040
		15	-0.074	-0.103	22.599	0.047
		16	-0.013	-0.024	22.625	0.067
		17	0.053	0.034	23.056	0.083
		18	-0.105	-0.070	24.778	0.074
		19	-0.182	-0.146	30.055	0.026
		20	0.092	0.063	31.394	0.026

Date: 02/25/17 Time: 13:31
Sample: 1975Q1 2008Q3
Included observations: 134
residuals from AR(4) model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.032	0.032	0.1413	
		2	0.031	0.030	0.2749	
		3	0.034	0.032	0.4337	
		4	0.069	0.066	1.0957	
		5	-0.077	-0.083	1.9315	0.165
		6	0.036	0.036	2.1155	0.347
		7	0.149	0.149	5.2995	0.151
		8	0.043	0.032	5.5614	0.234
		9	0.046	0.044	5.8654	0.320
		10	-0.005	-0.031	5.8696	0.438
		11	0.002	-0.017	5.8700	0.555
		12	-0.078	-0.063	6.7815	0.560
		13	-0.021	-0.027	6.8510	0.653
		14	-0.038	-0.048	7.0708	0.719
		15	-0.041	-0.052	7.3252	0.772
		16	-0.023	-0.024	7.4099	0.829
		17	0.034	0.036	7.5912	0.869
		18	-0.078	-0.071	8.5350	0.860
		19	-0.161	-0.143	12.652	0.629
		20	0.052	0.077	13.079	0.667

Residuals for the AR(2) model do not appear to come from a white noise - there is some time dependence left in the residuals, since the AC and PAC functions at lag 4 are outside of the 95% confidence interval around zero, so those autocorrelation coefficients are statistically significant (which can be also seen by the low p values in the Prob column).

Residuals for the AR(4) are very likely to be a white noise - there is no time dependence present in these residuals, AC and PAC functions at all lags are inside of the 95% confidence interval around zero, and thus are statistically insignificant (which can be also seen by the p values in the Prob column that exceed all three common thresholds, 0.1, 0.05 and 0.01).