# Practice Problems 1

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

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

**Question 3.** Define white noise.

**Question 4.** Explain what loss function is.

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

**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.

**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.

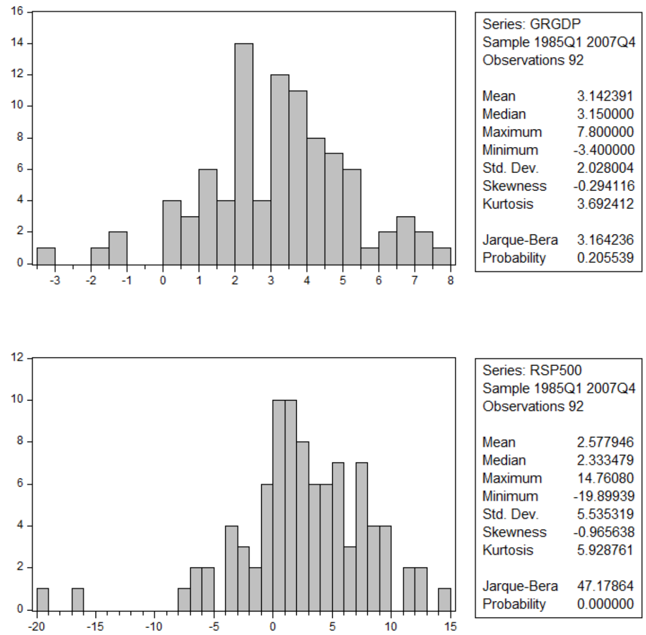
**Question 8.** Explain how increasing $\phi_1$ in an AR(1) model changes the behavior of time series $Y_t$.

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

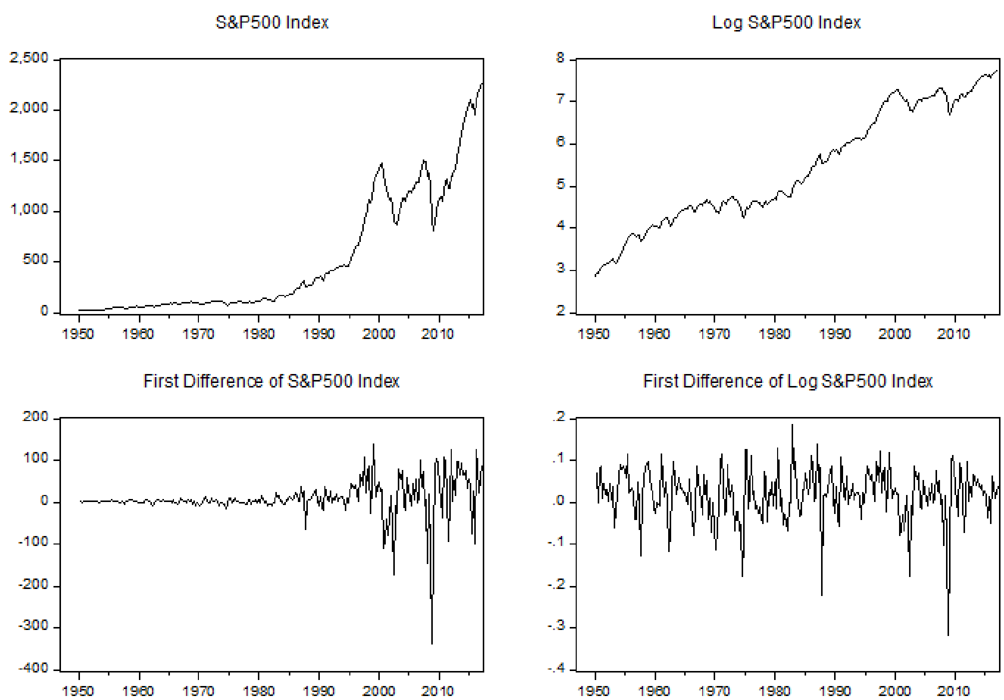
**Question 10.** Define an MA(4) model and describe how its AC and PAC functions look like.

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

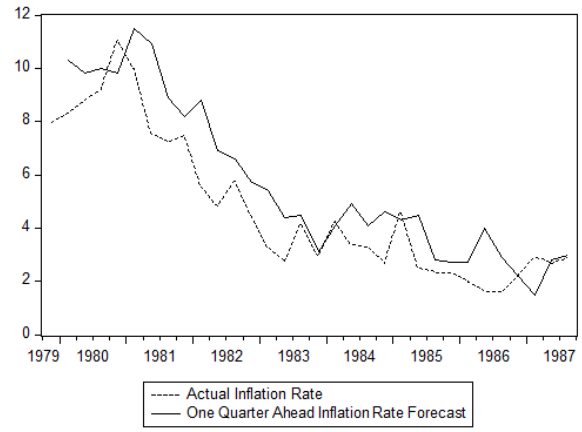
**Question 14.** Figure below shows the histograms for the real GDP growth rate and the quarterly return for S&P500 Index during the period 1985Q1-2007Q4. Is the GDP growth rate normally distributed in this sample? How about the returns for S&P500 Index?



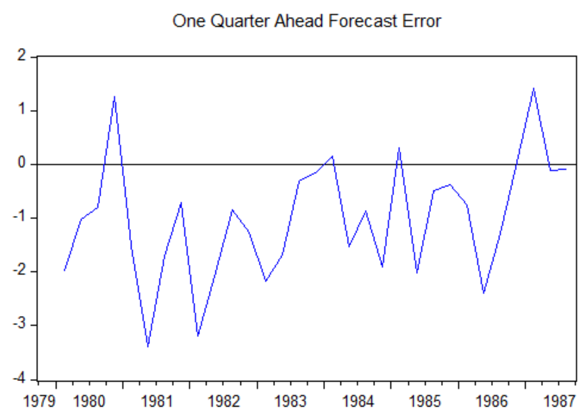

**Question 15.** Figure below shows the time series for the S&P500 Index, the log transformed S&P500 Index, and also their first differences. Explain which of the four series are nonstationary, first order weakly stationary, second order weakly stationary.



**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 $\beta_0$ 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?

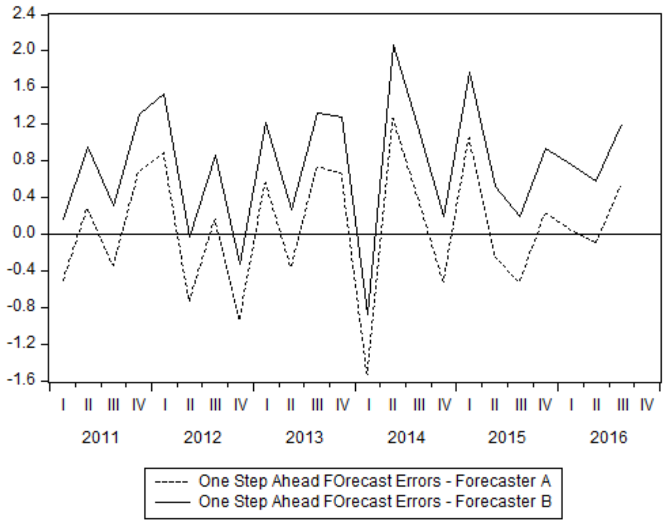



Dependent Variable: GPGDP_E1
Method: Least Squares
Date: 02/24/17 Time: 19:34
Sample (adjusted): 1980Q1 1987Q3
Included observations: 31 after adjustments

| 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 | | |

**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 $f_{t,1}^{(B)} = \mu_{t+1|t} - \sigma^2_{t+1|t}$, where $\mu_{t+1|t} = E(y_{t+1}|I_t)$ is the conditional mean, $\sigma^2_{t+1|t} = var(y_{t+1}|I_t)$ the conditional variance. The forecast errors are thus $e_{t,1}^{(A)} = y_{t+1} - \mu_{t+1|t}$ and $e_{t,1}^{(A)} = y_{t+1} - \mu_{t+1|t} + \sigma^2_{t+1|t}$ 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?




**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 |

**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 |