Tutorial 2

1. Assume a standard normal white noise process $W_t \overset{iid}{\sim} N(0,1)$. Check if the processes below are weakly stationary.
   
   (a) $X_t = W_t^2$.
   
   (b) $X_t = W_t + t$.

2. Plot the daily data on DAX in levels as well as daily log-returns of DAX. Which processes are those series likely to follow?

3. Generate and plot time series processes with size of 1000 observations that follow.
   
   (a) MA(1) process given by: $X_t = \varepsilon_t + 0.5\varepsilon_{t-1}$, where $\{\varepsilon_t\} \overset{iid}{\sim} N(0,1)$.
   
   (b) MA(2) process given by: $X_t = \varepsilon_t + 0.5\varepsilon_{t-1} + 0.4\varepsilon_{t-2}$, where $\{\varepsilon_t\} \overset{iid}{\sim} N(0,1)$.
   
   (c) AR(1) process given by: $X_t = 2 + 0.6X_{t-1} + \varepsilon_t$, where $\{\varepsilon_t\} \overset{iid}{\sim} N(0,0.36)$.
   
   (d) AR(2) process given by: $X_t = 0.75X_{t-1} + 0.45X_{t-2} + \varepsilon_t$, where $\varepsilon_t \overset{iid}{\sim} N(0,0.25)$.
   
   (e) ARMA(1,1) process given by: $X_t = 0.5X_{t-1} + 0.25\varepsilon_{t-1} + \varepsilon_t$, where $\varepsilon_t \overset{iid}{\sim} N(0,0.25)$.

   *Hint:* For random (standard normally distributed) number generation use EViews function ‘nrnd’. In general form, to generate a normally distributed random number, $e \sim N(\mu,\sigma^2)$, use the equation given by $e = \mu + \sigma * nrnd$.

4. Calculate and compare ACF for the processes given below. Generate time series that follow those processes. Plot the corresponding correlograms and compare the ACF estimates provided by EViews with those obtained my manual calculation.
   
   (a) $Y_t = Z_t + \frac{3}{2}Z_{t-1} - \frac{3}{2}Z_{t-2}$, where $Z_t \overset{iid}{\sim} N(0,1)$.
   
   (b) $X_t = W_t - \frac{1}{6}W_{t-1} - \frac{1}{6}W_{t-2}$, where $W_t \overset{iid}{\sim} N(0,9)$.

5. Generate a series of squared log-return of daily DAX. Fit the data to an $ARMA(p,q)$ model. Is it reasonable to use this model? Justify your answer by looking at the residuals.