1) Consider the AR(2) process \( x_t = x_{t-1} - 5x_{t-2} + \epsilon_t \). Determine whether the process is stationary.

2) Use the ACF and PACF to identify ARIMA\((p, d, q)\) models for the Housing Starts series, the log of the GDP series, the first differences of the log of the GDP series, and the first differences of the log of the CPI series (commonly known as "inflation"). Give reasons for your choices of \( p, d, q \) for each series. Do not try to estimate parameters. Just select \( p, d, q \).

3) For the first difference of the log GDP series, use the method described in the handout for Chapter 3, Part IV, page 6 to estimate \( b \) in the invertible MA(1) model \( x_t = \epsilon_t + b \epsilon_{t-1} \).

4) For the first difference of the log GDP series, use the Yule-Walker equation \( r_1 = \hat{a}_1 r_0 \) to estimate \( a_1 \) in the AR(1) model \( x_t = a_1 x_{t-1} + \epsilon_t \). Is your fitted model stationary?

5)

A) For the first difference of the log GDP series, use the two Yule-Walker equations

\[
\begin{align*}
    r_2 &= \hat{a}_1 r_1 + \hat{a}_2 r_0 \\
    r_1 &= \hat{a}_1 r_0 + \hat{a}_2 r_1
\end{align*}
\]

to estimate \( a_1 \) and \( a_2 \) in the AR(2) model \( x_t = a_1 x_{t-1} + a_2 x_{t-2} + \epsilon_t \).

B) Prove that your fitted AR(2) model is stationary. (It must be stationary, since it can be proved in general that AR models estimated by solving the Yule-Walker equations are always stationary).

C) Use your fitted model to forecast the log GDP (not just the first difference of the log GDP, but the log GDP itself) for the second quarter of 2016. (This is a one-step-ahead forecast for log GDP, based on an ARIMA\((2, 1, 0)\) model).