Homework 1

ECON312 Time Series Analysis

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Instructions

- The homework is due at due-time on **due-date**. No late submissions will be accepted.
- Students are encouraged to submit answers typed in TeX format. Such submissions will be rewarded with a bonus of 2% of the final grade.
- Homeworks must be submitted (uploaded to the course page) in pdf format named *Name_Surname.pdf*.

Assignment 1

Consider an $AR(1)$ process given by

$$y_t = \rho y_{t-1} + \epsilon_t \qquad \epsilon_t \sim IID(0, \sigma^2)$$

with $|\rho| < 1$ and $\sigma^2 > 0$.

1. Show that the process may be written as

$$y_t = \sum_{j=0}^{\infty} \rho^j \epsilon_{t-j}$$

   Hint: use backward substitutions for lags of y_t.

2. Using the expression above, show that

$$E(y_t) = 0$$

3. Similarly, show that

$$Var\left(y_t\right) = \frac{\sigma^2}{1-\rho^2}$$

4. Finally, show that

$$Cov\left(y_t, y_{t-j}\right) = \frac{\rho^j \sigma^2}{1-\rho^2} \qquad \text{for} \quad j > 0$$