Suppose we have the following AR(2) process

$$y_t = 0.5y_{t-1} + 0.5y_{t-2} + \epsilon_t \tag{1}$$

where the innovation $\epsilon_t$ is the white noise:

$$\epsilon_t \sim N(0, 1) \tag{2}$$

## 1: Conditional expectations

**(a)** Compute $E(y_t|y_{t-1}, y_{t-2}, ....)$

**(b)** Compute $E(y_t, y_{t-2}, y_{t-3}, ...)$

## 2: Linear forecast - Linear projection

We consider the following linear forecast

$$x_t = 0.5y_{t-1} + 0.5y_{t-2} \tag{3}$$

**(a)** If $\epsilon_t$ are identically and independently distributed, is $x_t$ a linear projection?

**(b)** If $cov(\epsilon_t, \epsilon_{t-1}) = 0.3$ for any $t$, is $x_t$ a linear projection?

## 3: Optimal forecast

What is the optimal forecast of $y_t$?