Assignment 1 – prediction model parameter identification using LMS (this is not a team assignment)

Due date: 2/15/2021 (11:59pm)

- Report naming convention: Team#_lastname_keyword (this is not a team assignment though)
- Report: 1-2 pages in IEEE format (your code does not contribute to the page count).
- Turn in 1 pdf file that includes the report and the simulation code with clear annotation.

Step 1. Generate training data using a mathematical model (because we don't have access to the physical process to collect data from, we use simulations to generate data).

Use the following equation (1) to generate 500 data pairs of {x(k-1), x(k)}.

$$x(k) = ax(k-1) + \varepsilon(k) \qquad (1)$$

In the above equation, a=0.99, $\varepsilon(n)$ is a zero mean Gaussian white noise of variance 0.02. You can generate 500 random input samples using another zero mean Gaussian white noise of variance 0.995.

Step 2. Now you are asked to estimate the parameter a in equation (1) using the LMS algorithm. You can start from $\hat{a}(0) = 0$, and use a learning rate of 0.001.

Your result is correct if your estimate of a is very close to 0.99.

In your report, describe how you terminate the learning process.

Step 3. Record the final estimated a value in your report. Plot $\hat{a}(n)$ and also the instantaneous cost $\mathcal{E}(n)$ for n=0, 1, 2, …, 5000.