University of California Santa Barbara

Homework #5

Introduction to EE

ECE 3

Instructor: Christos Thrampoulidis

First & Last Name: _____

Perm Number: _____

For instructor use:

Question:	1	2	Total
Points:	11	26	37
Score:			

Instructions:

- Write your name in the space provided above.
- Please consult the Syllabus for HW grading and late-submission policies.
- Please first solve the problem in draft paper and present your **complete** final answer in *clean* form on the space provided. **Answer all of the questions in the spaces provided. Answers are expected to be succinct but complete.** Please only use extra space (attach to the end of your submission) if absolutely necessary.
- The HW is **due Friday December 6 12:00pm sharp**.
- The HW set includes **Programming Assignments** marked as **(P.A.)**. Create a new Jupyter notebook and write code for each one of them. Execute the code to obtain the desired results (e.g., plot of the signals). Upload the notebook **including the code and its output** on GauchoSpace. **Attach a printed copy of your code.**
- **Return a paper copy of your HW to the homework box in HF.**
- **The returned copy should include a printout of your code for the Programming assignments. Also upload your P.A.s to GauchoSpace.**

1. **Problem 1 [FIR].** Compute and plot the output $\{y[n]\}_n$ of an FIR system with impulse response $\{h[n]\}_n$ and input $\{x[n]\}_n$ as shown below:

$$x[n] = \begin{cases} 2 & , n = 0, \\ 4 & , n = 1, \\ 6 & , n = 2, \\ 0 & , n = 3, \\ 2 & , n = 4, \\ 0 & , \text{otherwise} \end{cases} \qquad h[n] = \begin{cases} 3 & , n = 0, \\ -1 & , n = 1, \\ 0 & , n = 2, \\ 1 & , n = 3, \\ 0 & , \text{otherwise} \end{cases}$$

(a) (2 points) What is the support of the input signal? What is its length N?

(b) (2 points) What is the support of the impulse response? What is the order M of the Filter?

(c) (1 point) Is the filter causal? Why?

(d) (2 points) What is the length of the output signal $\{y[n]\}_n$?

(e) (4 points) Compute and plot the output $\{y[n]\}_n$ of the FIR filter.

2. **Problem 2 [Program it!]. (P.A.)** Download the notebook "HW5.ipynb". Answer all the questions by filling in the missing commands. Please save your completed file as a pdf and return a hard copy. Also, upload your notebook at Gauchospace.

   (a) (26 points)

End of HW #5