EE3210 Signals and Systems

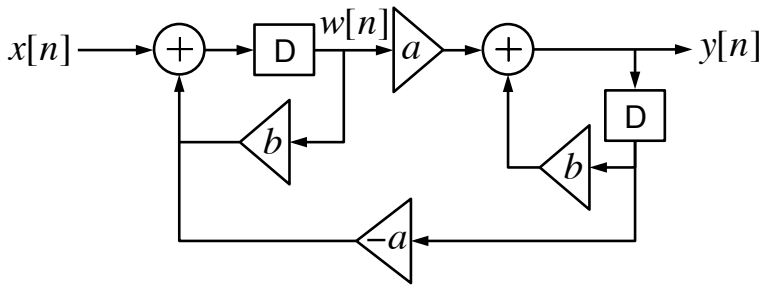
Assignment 4

Instructions:

1. There are four problems in this assignment. Answer all questions.
2. The total marks for this assignment is 8 marks.
3. In answering the questions, you need to note that:
   - It is important for you to show us your intermediate steps and tell us what arguments you have made to obtain the results.
   - Both the intermediate steps and the arguments carry marks.
   - If you can show us the perfect intermediate steps and the in-between arguments but get the final results wrong for some reason, we will still award you marks for having understood the subject matter.
4. The submission deadline is 5pm Saturday 29 March 2014.
5. Late submission penalty: 20% per day will be subtracted for late submission. Submissions that are overdue for more than four days will receive **ZERO** mark.
6. Submit your assignment on e-Portal/Blackboard.
   - The file must be in Acrobat `pdf` format.
   - The file must be named with the format `Assignment4-student ID.pdf`.
     - For example, if your student ID is 12345678, the file name must be: `Assignment3-12345678.pdf`.
7. For information on how to submit assignments on e-Portal/Blackboard, see

   `http://www6.cityu.edu.hk/elearn/animation/student/submit_assignment.htm`

Problem 1: (2.5 marks) Consider a discrete-time LTI system with a block diagram representation as shown in the figure below.

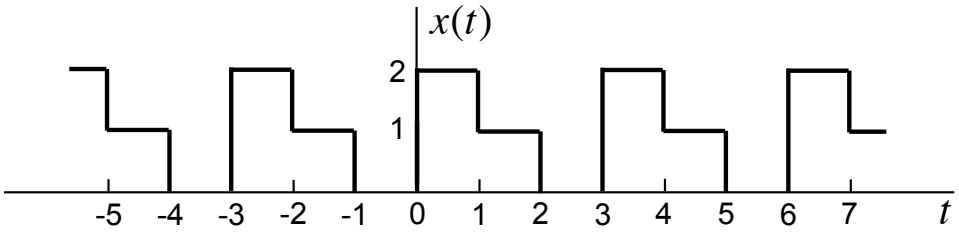


(a) Determine the linear constant-coefficient difference equation that describes the relationship between the input $x[n]$ and the output $y[n]$ of the system.

(b) Draw the block diagram representation of the system in direct form I.

(c) Draw the block diagram representation of the system in direct form II.

Problem 2: (2 marks) Determine the Fourier series representation of the following continuous-time periodic signal $x(t)$:



Problem 3: (2 marks) Let $x(t)$ be a continuous-time periodic signal with fundamental period T and Fourier series coefficients a_k. Derive the Fourier series coefficients of each of the following signals in terms of a_k:

(a) $x(t - t_0) + x(t + t_0)$

(b) $\mathcal{E}\{x(t)\}$

(c) $x(3t - 1)$

Problem 4: (1.5 mark) Let $x[n]$ be a discrete-time periodic signal with fundamental period N. Determine, for an arbitrary positive integer m, whether or not $x[mn]$ is a periodic signal. If $x[mn]$ is periodic, determine an expression of its fundamental period.

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