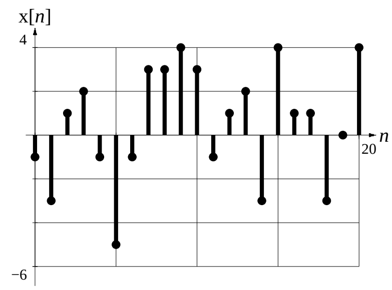
Solution to ECE 315 Test #2 F04

1. The signal, x$[n]$, is defined by the figure below. Let y$[n]$ be the first backward difference of x$[n]$ and let z$[n]$ be the accumulation of x$[n]$. (Assume that x$[n]$ is zero for all $n < 0$).

(a) (3 pts) What is the numerical value of y[4]? $\mathrm{y}[4] = \mathrm{x}[4] - \mathrm{x}[3] = -1 - 2 = -3$

(b) (5 pts) What is the numerical value of z[6]? $\mathrm{z}[6] = \sum_{-\infty}^{6} \mathrm{x}[m] = -1 - 3 + 1 + 2 - 1 - 5 - 1 = -8$



2. (1 pt) When a DT signal is time-compressed an effect occurs which has no counterpart in CT-signal time-compression. What is it called? Decimation

3. (10 pts) A DT signal, x$[n]$, is periodic with period, $N_0 = 6$. Some selected values of x$[n]$are $\mathrm{x}[0] = 3$, $\mathrm{x}[-1] = 1$, $\mathrm{x}[-4] = -2$, $\mathrm{x}[-8] = -2$, $\mathrm{x}[3] = 5$, $\mathrm{x}[7] = -1$, $\mathrm{x}[10] = -2$, $\mathrm{x}[-3] = 5$. What is the numerical value of its average signal power, P_x?

We need the values in one period. $\mathrm{x}[0] = 3, \mathrm{x}[1] = \mathrm{x}[1+6] = \mathrm{x}[7] = -1, \mathrm{x}[2] = \mathrm{x}[2-6] = \mathrm{x}[-4] = -2, \mathrm{x}[3] = 5, \mathrm{x}[4] = \mathrm{x}[4-6-6] = \mathrm{x}[-8] = -2, \mathrm{x}[5] = \mathrm{x}[5-6] = \mathrm{x}[-1] = 1$ $P_x = \frac{1}{N_0} \sum_{<N_0>} |\mathrm{x}[n]|^2 = \frac{1}{6} \sum_0^5 |\mathrm{x}[n]|^2 = \frac{9+1+4+25+4+1}{6} = \frac{44}{6} = 7.333\ldots$

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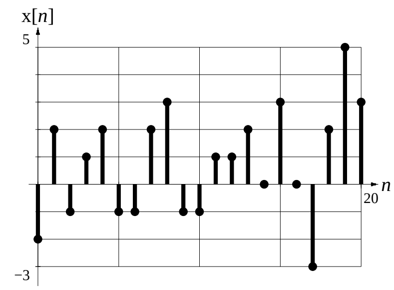
(a) (3 pts) What is the numerical value of y[4]? $\mathrm{y}[4] = \mathrm{x}[4] - \mathrm{x}[3] = 2 - 1 = 1$

(b) (5 pts) What is the numerical value of z[6]? $\mathrm{z}[6] = \sum_{-\infty}^{6} \mathrm{x}[m] = -2 + 2 - 1 + 1 + 2 - 1 - 1 = 0$



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3. (10 pts) A DT signal, x$[n]$, is periodic with period, $N_0 = 6$. Some selected values of x$[n]$are $\mathrm{x}[0] = 3$, $\mathrm{x}[-1] = 1$, $\mathrm{x}[-4] = -2$, $\mathrm{x}[-8] = -2$, $\mathrm{x}[3] = 5$, $\mathrm{x}[7] = -4$, $\mathrm{x}[10] = -2$, $\mathrm{x}[-3] = 5$. What is the numerical value of its average signal power, P_x?

We need the values in one period. $\mathrm{x}[0] = 3, \mathrm{x}[1] = \mathrm{x}[1+6] = \mathrm{x}[7] = -4, \mathrm{x}[2] = \mathrm{x}[2-6] = \mathrm{x}[-4] = -2, \mathrm{x}[3] = 5, \mathrm{x}[4] = \mathrm{x}[4-6-6] = \mathrm{x}[-8] = -2, \mathrm{x}[5] = \mathrm{x}[5-6] = \mathrm{x}[-1] = 1$ $P_x = \frac{1}{N_0} \sum_{<N_0>} |\mathrm{x}[n]|^2 = \frac{1}{6} \sum_0^5 |\mathrm{x}[n]|^2 = \frac{9+16+4+25+4+1}{6} = \frac{59}{6} = 9.833\ldots$

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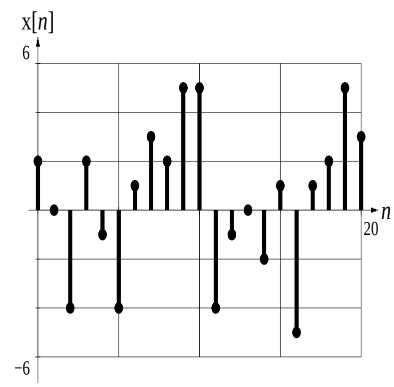
(a) (3 pts) What is the numerical value of y[6]? $\mathrm{y}[6] = \mathrm{x}[6] - \mathrm{x}[5] = 1 - (-4) = 5$

(b) (5 pts) What is the numerical value of z[4]? $\mathrm{z}[4] = \sum_{-\infty}^{4} \mathrm{x}[m] = 2 + 0 - 4 + 2 - 1 = -1$



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3. (10 pts) A DT signal, x[n], is periodic with period, $N_0 = 6$. Some selected values of x[n]are x[0] = 3, x[−1] = 1, x[−4] = 3, x[−8] = −2, x[3] = 5, x[7] = −1, x[10] = −2, x[−3] = 5. What is the numerical value of its average signal power, P_x?

We need the values in one period. $\mathrm{x}[0] = 3, \mathrm{x}[1] = \mathrm{x}[1+6] = \mathrm{x}[7] = -1, \mathrm{x}[2] = \mathrm{x}[2-6] = \mathrm{x}[-4] = 3, \mathrm{x}[3] = 5, \mathrm{x}[4] = \mathrm{x}[4-6-6] = \mathrm{x}[-8] = -2, \mathrm{x}[5] = \mathrm{x}[5-6] = \mathrm{x}[-1] = 1$ $P_x = \frac{1}{N_0} \sum_{<N_0>} |\mathrm{x}[n]|^2 = \frac{1}{6} \sum_{0}^{5} |\mathrm{x}[n]|^2 = \frac{9+1+9+25+4+1}{6} = \frac{49}{6} = 8.166\ldots$

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(a) (3 pts) What is the numerical value of y[4]? $\mathrm{y}[4] = \mathrm{x}[4] - \mathrm{x}[3] = -4 - 3 = -7$

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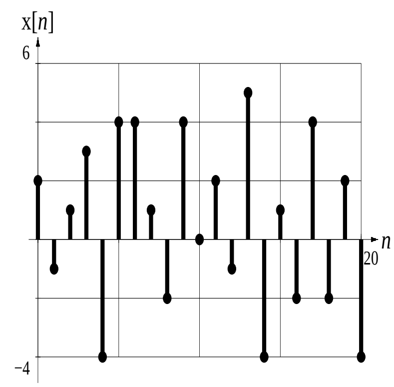

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