PROBLEM:

Consider a system defined by $$y[n] = \sum_{k=0}^{20} b_k x[n-k]$$

Suppose that the input signal $x[n]$ is equal to zero for $n < 100$, and also for $n > 200$. Then it is possible to find regions of n where the output is guaranteed to be zero.

(a) Show that $y[n]$ is zero for $n < N_1$, and find the integer N_1 for which this is true.
(If it is convenient assume that $x[n]$ is equal to one for $n = 100, 101, 102, 103, \ldots, 200$.)

(b) In addition, $y[n]$ will be zero for $n > N_2$. Find the integer N_2 for which this is true.

Hints: recall the sliding window interpretation of the FIR filter. In addition, analyze the index $[n-k]$ *when* n *is fixed and* k *varies over the summation range.*

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SOLUTION

$y[n] = \sum_{k=0}^{20} b_k x[n-k]$ is guaranteed to be zero

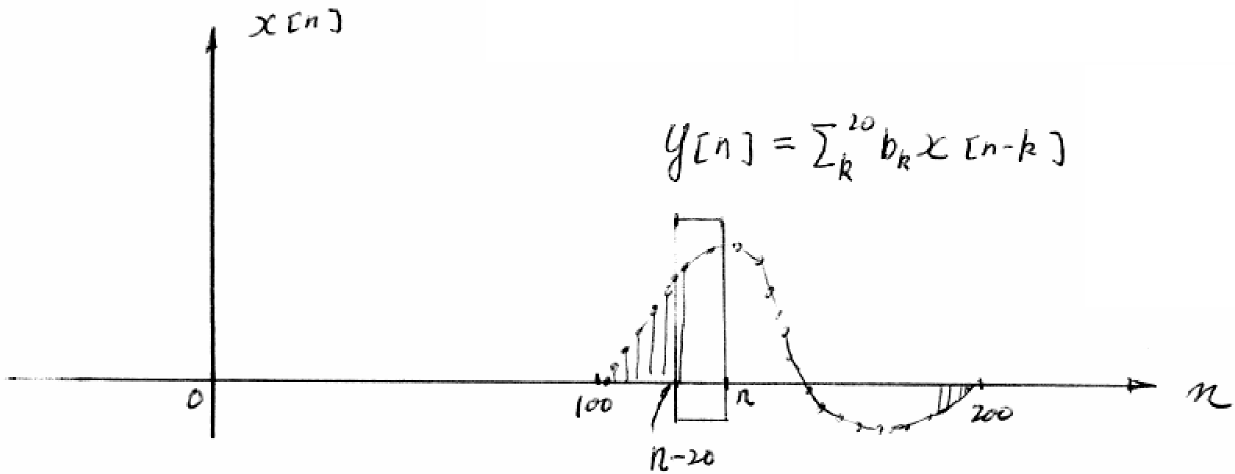
$\Rightarrow \quad x[n-k] = 0 \quad$ for $k = 0, 1, \ldots, 20$

(a) $\quad n - k < 100 \quad$ for $k = 0, 1, \ldots, 20$

$\quad n < 100 \quad \Longrightarrow \quad N_1 = 100$

(b) $\quad n - k > 200 \quad$ for $k = 0, 1, \ldots, 20$

$\quad n > 200 + 20 \quad \Longrightarrow \quad N_2 = 220$



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