Problem 0.1

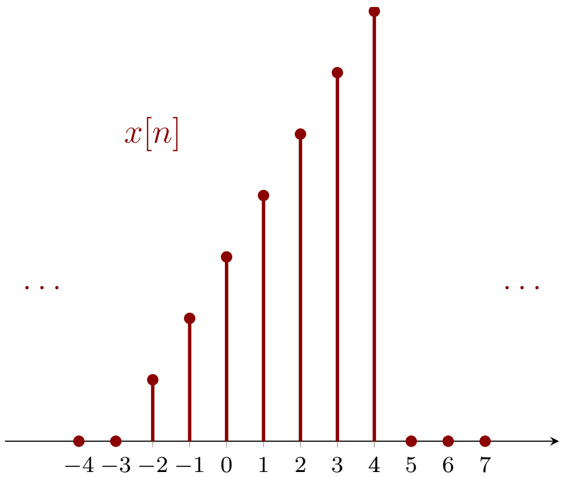
Problem 1.4 Let $x[n]$ be a signal with $x[n]=0$ for$n<-2$ and $n>4$, for each signal given below, determine the values of n for which it is guaranteed to be zero.

$$\begin{array}{ll} (\mathbf{a}) & x[n-3] \\ (\mathbf{b}) & x[n+4] \\ (\mathbf{c}) & x[-n] \\ (\mathbf{d}) & x[-n+2] \\ (\mathbf{e}) & x[-n-2] \end{array}$$

For the given signals (**a**) to (**e**), the transformations of the variable n will change the interval in which the signals are zero. For the convenience of calculation, we write the origin signal as:

$$x[m]=0, m<-2 \quad \text{and} \quad m>4$$

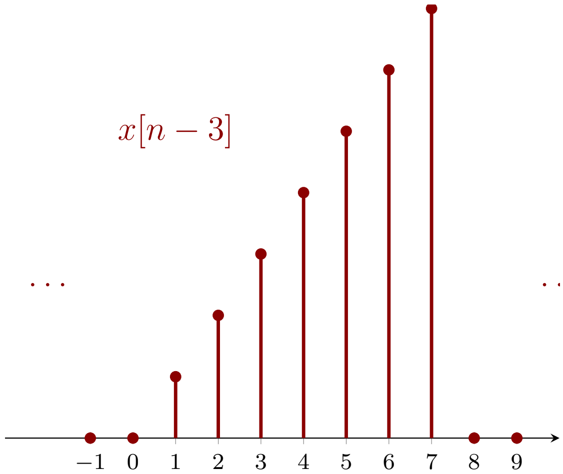
We can visualize $x(m)$ as below (I just give an example, you can name any signal that satisfy $x[m]=0, m<-2$ and $m>4$):



(**a**) : $x[n-3]$
For signal (**a**), to get the interval where $x[n-3]=0$, we have:

$$\begin{aligned} t=n-3 &< -2 \\ t=n-3 &> 4 \end{aligned}$$

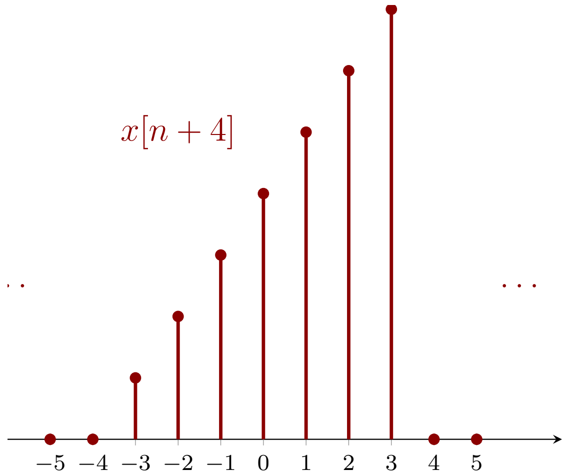
Then, we have $n<1$ and $n>7$ from which we can see that the new signal is a right shift with step three relative to the origin signal. The new signal is delayed with three.



(**b**) : $x[n+4]$
For signal (**b**), we have:

$$\begin{aligned} t = n+4 &< -2 \\ t = n+4 &> 4 \end{aligned}$$

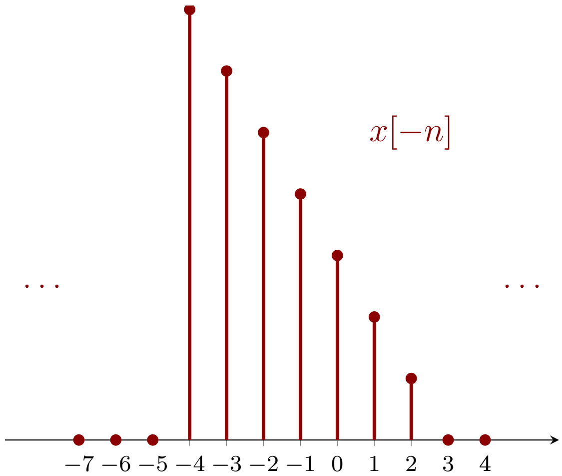
Then, we have $n < -6$ and $n > 0$ from which we can see that the new signal is a left shift with step four relative to the origin singal. The new signal is advanced with four.



(**c**) : $x[-n]$
For signal (**c**), we have:

$$\begin{aligned} t = -n &< -2 \\ t = -n &> 4 \end{aligned}$$

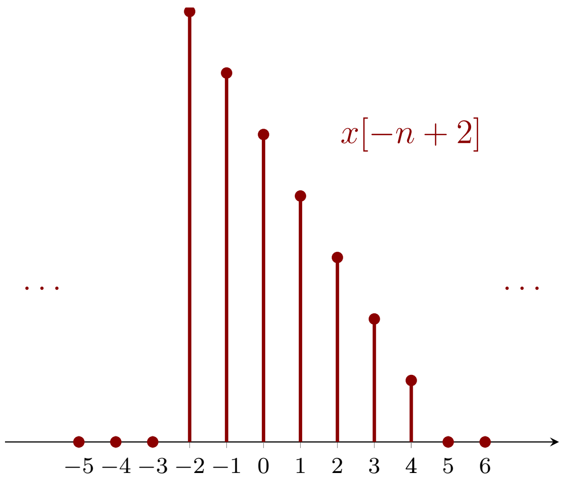
Then, we have $n > 2$ and $n < -4$ from which we can see that the new signal is a reversal of the origin signal.



$(\mathbf{d}): x[-n+2]$
for signal $(\mathbf{d})$, we have:

$$
\begin{aligned}
t = -n+2 &< -2 \\
t = -n+2 &> 4
\end{aligned}
$$

Then, we have $n > 4$ and $n < -2$. For $x[-n+2]$, we can first flip the original signal then right shift the flipped signal by 2. Notice the contents in the brackets $-(n+2)$. I would like treat it as $-(n-2)$, by which I know that the minus symbol means reversal and -2 means right shift by 2.



$(\mathbf{e}): x[-n-2]$
For signal $(\mathbf{e})$, we have:

$$
\begin{aligned}
t = -n-2 &< -2 \\
t = -n-2 &> 4
\end{aligned}
$$

Then, we have $n > 0$ and $n < -6$. To get the new signal, we have to filp the original signal first then left shift the flipped one by two.