$[a_3-3,\ a_2-3]$

$\vdots$

$[a_d-d,\ a_{d-1}-d]$

$[-(d+1),\ a_d-(d+1)]$

$$\cdots a_4-4 < a_4-3 \le a_3-3 < a_3-2 \le a_2-2 \le \overset{a_1-2<}{a_1-1} \le n-k$$

As we saw above, $d-1$ number of c_i-i's are in those intervals, which are disjoint each other.
"More closer look."
Consider $[a_j-j,\ a_{j-1}-j] = A$
$[a_{j+1}-(j+1),\ a_j-(j+1)] = B$.

$\Rightarrow \quad c_j-j \in [a_{j+1}-(j+1),\ a_{j-1}-j]$
which contains A & B.
Except c_j-j, the rest are in one of those intervals. $\Rightarrow$ We can conclude that at most one of c_i-i's lies in each of the $(d+1)$ - closed disjoint intervals.
$\Rightarrow$ We see that exactly one of those intervals will fail to contain an integer c_i-i. For, if $c_j-j \notin A\cup B$, since $c_j-j \in [a_{j+1}-(j+1),\ a_{j-1}-j]$, c_j-j must be in $(a_j-(j+1),\ a_j-j)$,

$$\Rightarrow \quad a_j-(j+1) < c_j-j < a_j-j$$
$$\Rightarrow \quad a_j-1 < c_j < a_j \quad \Rightarrow \text{impossible}$$
because a_j & c_j are integers.