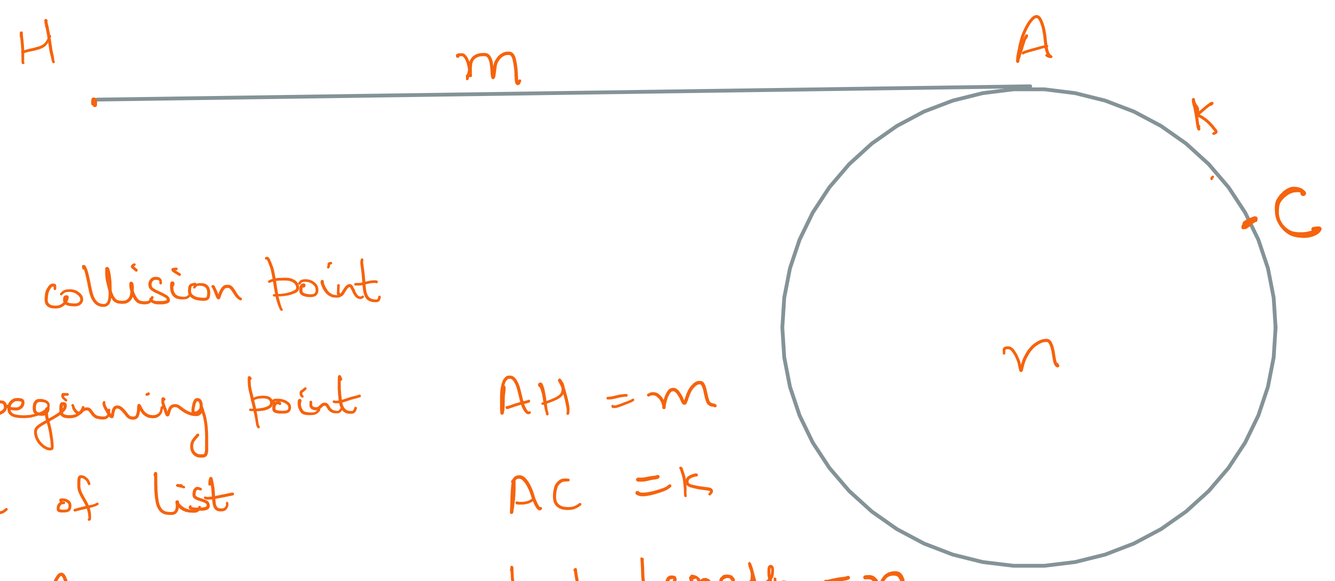
Beginning point of cycle in linked list

Friday, 11 February 2022 12:20 AM



C → Initial collision point

A → Loop beginning point

H → Head of list

To find : A

AH = m

AC = K

loop length = n

→ When slow & fast pointers meet at C, following conditions must hold:

- Distance travelled by slow pointer till collision at C (d1):

  $d1 = m + \alpha n + K$ (α : no. of complete cycles done by slow pointer before collision)

- Distance travelled by fast pointer till collision at C (d2):

  $d2 = m + \beta n + K$ (β : no. of complete cycle done by fast pointer before collision)

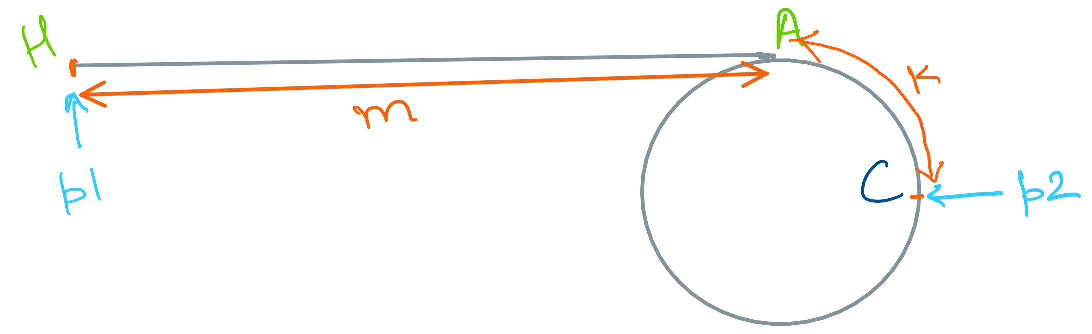
Also, $2(d1) = d2$

$\Rightarrow 2(m + \alpha n + K) = m + \beta n + K$

$\Rightarrow m + K = (\beta - 2\alpha) n \Rightarrow m + K = \gamma n$

$\Rightarrow$ $(m+K)$ is multiple of cycle length

→ After collision, let us move one of the pointer (p1) back to head and keep other (p2) at collision point C.



- Moving p1 for (m+K) steps will lead it to C (see figure)
- Moving p2 for (m+K) steps will lead it back to C (p2 starts from C, complete γ cycles and again stops at C)

→ Both above points prove moving p1 & p2 both for (m+K) will result in their collision at C

→ Instead of moving both pointers (m+K) steps, if we move them for m steps only, they will meet at point K distance before C, which comes out to be A ie our answer