

Detect Loop in a Linked List

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Suppose the entire length of the graph is L , the length of the loop is r . Given two nodes, p_f and p_s , depart at the same time with speed v_f and v_s , where $v_f = 2v_s$.

Also we should notice that assuming both nodes start in the beginning of the loop, when they meet, p_f would be r -distance faster than p_s . Because we have:

$$r = v_s t \tag{1}$$

$$v_f = 2v_s, \tag{2}$$

where t is the time they spend on the loop. We substitute v_s in (1) with $\frac{v_f}{2}$ (2), we can get $v_f t = 2r$, which means p_f has passed 2 laps and $v_f t - v_s t = r$. So we can conclude that when they meet in the loop, p_f has to run one lap faster than p_s .

Now when p_s enters the loop, it would pass distance d with p_f 's passing the loop with distance d . It would be:

$$\begin{aligned} v_f t + d - v_s t &= r \\ v_s t &= r - d. \end{aligned} \tag{3}$$

From (3) we know that s_s is smaller than one loop (s denotes the distance that pointer passes on the loop).