

??

- 

?????????

1 2 java

1 2

A->B->C->D->B->C->D A 1 B
2 C 1 C 2 B 1
D 2 D

```
/**
 *
 * @param head
 * @return
 */
public static <T> boolean isLoopList(ListNode<T> head){
    ListNode<T> slowPointer, fastPointer;

    //
    slowPointer = fastPointer = head;
    while(fastPointer != null && fastPointer.next != null){
        slowPointer = slowPointer.next;
        fastPointer = fastPointer.next.next;

        //
        if(slowPointer == fastPointer){
            return true;
        }
    }
    return false;
}
```

D S S S
O N
O 1

????Set?????

@ set set set

set + 1

O(N) O(n)

????????????

```

fast slow slow ( ) (
1 )
n c n=s+p c n c
CB n-p=s s A n c
B(AB=CB=s)

```

```

/**
 * @param head
 * @return
 */
public static <T> ListNode<T> findEntranceInLoopList(ListNode<T> head){
    ListNode<T> slowPointer, fastPointer;

    //
    boolean isLoop = false;
    slowPointer = fastPointer = head;
    while(fastPointer != null && fastPointer.next != null){
        slowPointer = slowPointer.next;
        fastPointer = fastPointer.next.next;

        //
        if(slowPointer == fastPointer){
            isLoop = true;
            break;
        }
    }

    //
    if(isLoop){
        slowPointer = head;
        while(fastPointer != null && fastPointer.next != null){
            //
            if(slowPointer == fastPointer){

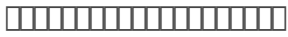
```

```

    return slowPointer;
}

slowPointer = slowPointer.next;
fastPointer = fastPointer.next;
}
}
return null;
}

```



$O(\text{len1} * \text{len2})$



hash

hash



hash

hash



$O(\max(\text{len1} + \text{len2}))$

$O(\text{len1})$



Hash



Hash



Hash



$O(m+n)$ $m \leq n$



Hash



$O(\text{len1} + \text{len2})$

K



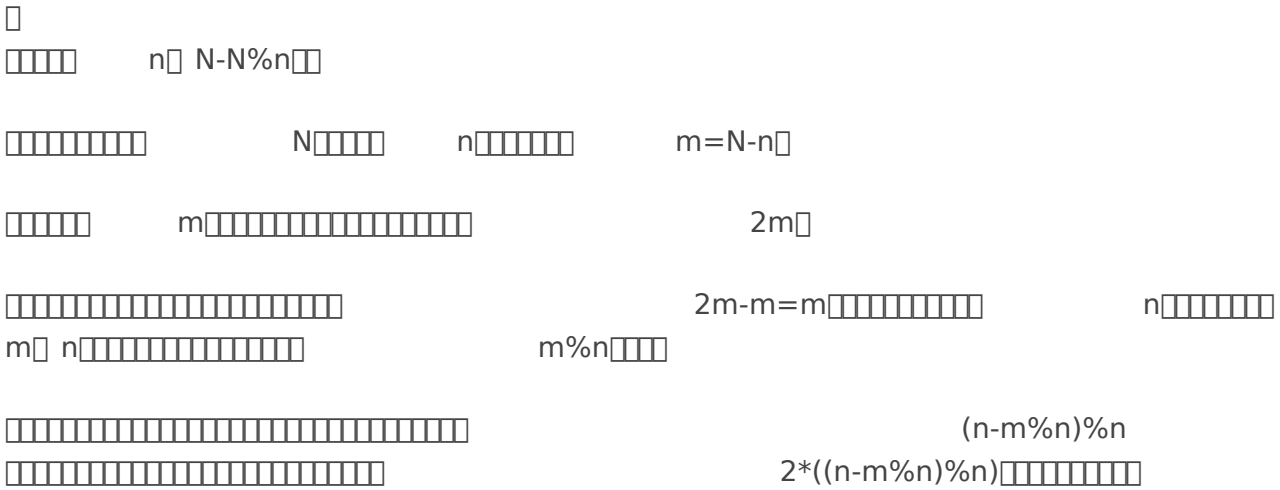
K




```

while (fast!=slow) {
    fast=fast->next;
    slow=slow->next;
}
return fast;
}
return NULL;
}

```



OK $d = m + (n - m \% n) \% n \square$

1. $n - m \% n \square 0 < n - m \% n <= n \square m = n \square n - m \% n = n \square m = n \square$
 $d = m + (n - m \% n) \% n \square d = n;$

2. $m != n \square 0 < n - m \% n < n \square (n - m \% n) \% n = n - m \% n \square d = m + n - m \% n = m + n - m \% n \square$

1 $m < n \square d = m + n - m = n;$

2 $m > n \square d = m + n - m \% n = N - (N - n) \% n = N - N \% n;$

\square

1 $m <= n \square d = n;$

2 $m > n \square d = N - N \% n;$

\square

