

Oct 25

# Merge Sort (a, n)

$$\begin{aligned} \lfloor 0.3 \rfloor &= 0 \\ \lceil 0.3 \rceil &= 1 \end{aligned}$$

$O(1)$  { If  $n=1$  then return  $a_1$

$O(n)$  {  $a_L = a_1, \dots, a_{\lfloor \frac{n}{2} \rfloor}$   
 $a_R = a_{\lfloor \frac{n}{2} \rfloor + 1}, \dots, a_n$  }  $\leq T(\lfloor \frac{n}{2} \rfloor)$  integer

If  $x$  is integer  
 $\lfloor x \rfloor = x$   
 $\lceil x \rceil = x$

return MERGE ( Merge Sort ( $a_L, \lfloor \frac{n}{2} \rfloor$ ),  
Merge Sort ( $a_R, n - \lfloor \frac{n}{2} \rfloor$ ))

$T(n)$  def max runtime of MergeSort over ALL inputs of size  $n$ .

$$T(n) \leq O(1) + O(n) + T(\lfloor \frac{n}{2} \rfloor) + T(n - \lfloor \frac{n}{2} \rfloor) + O(n)$$

If  $n=1$   $T(1) \leq O(1)$

$n > 1$ ,  $T(n) \leq O(n) + T(\lfloor \frac{n}{2} \rfloor) + T(n - \lfloor \frac{n}{2} \rfloor)$