Mergesort

$$T(n) = T(n/2) + T(n/2) + cn$$

cn ↑ Merge Time αn $= cn$

$$= 2\,\boxed{T(n/2)} + cn$$

$$= 2\left[2\left[T(n/4) + \frac{cn}{2}\right]\right] + cn$$

$$= 4T(n/4) + cn + cn$$

$$= 4T(n/4) + 2cn$$

$$= 2^k \cdot a + k\,cn$$

$$= an + \log_2 n \; cn$$

$$= an + c\,n\log_2 n$$

$$\Rightarrow O(n\log n)$$

$n = 2^k = 2^2$

$k = 2$

Low — mid — High

sort, merging

sorted

sorting, merging

Sorted | Sorted
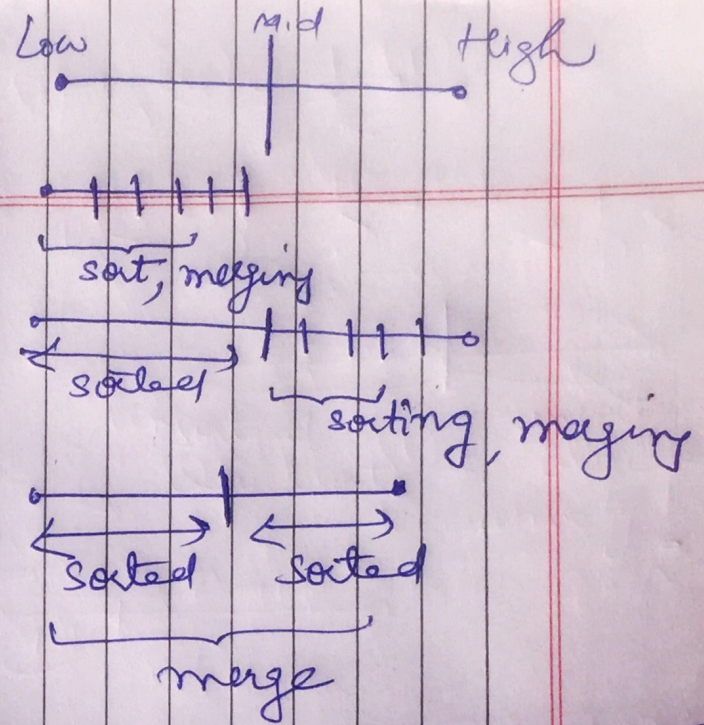
merge

```
Mergesort (low, high)
{
    Mergesort (low, mid)
    Mergesort (mid+1, high)
    Merge (low, mid, high)
}
```