Review 2

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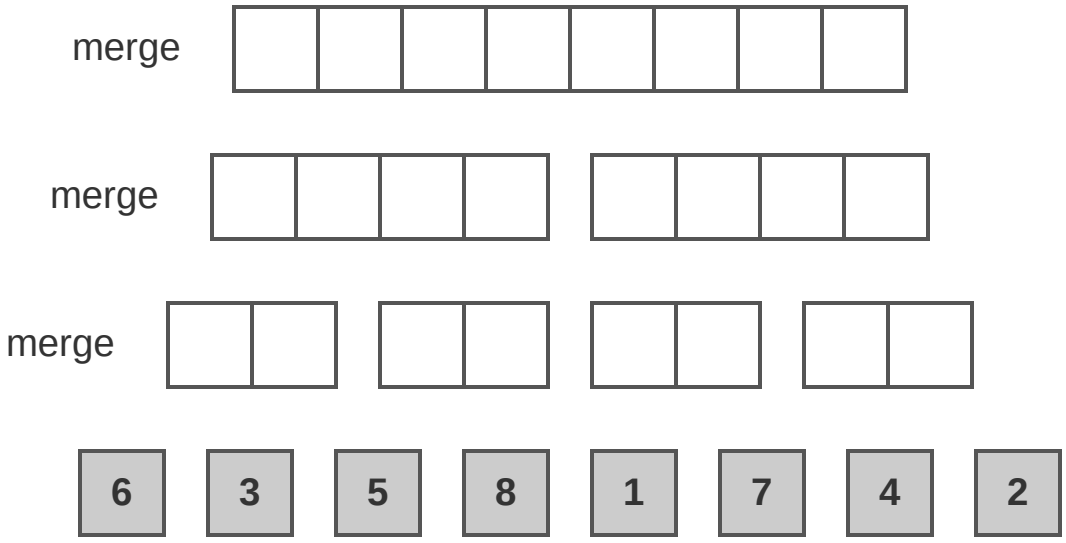
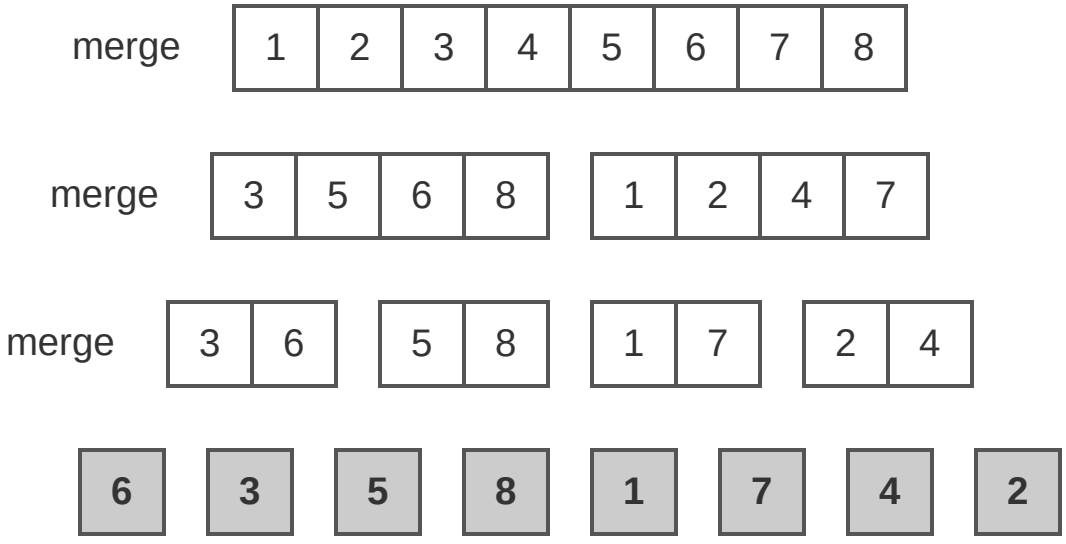
Problem 1

Fill in the blanks when the numbers are sorted by merge sort in non-decreasing order.



Solution 1



Problem 2

Fill in the blanks with proper asymptotic running times. Assume that `p = 1`, `r = n`

Solution 2

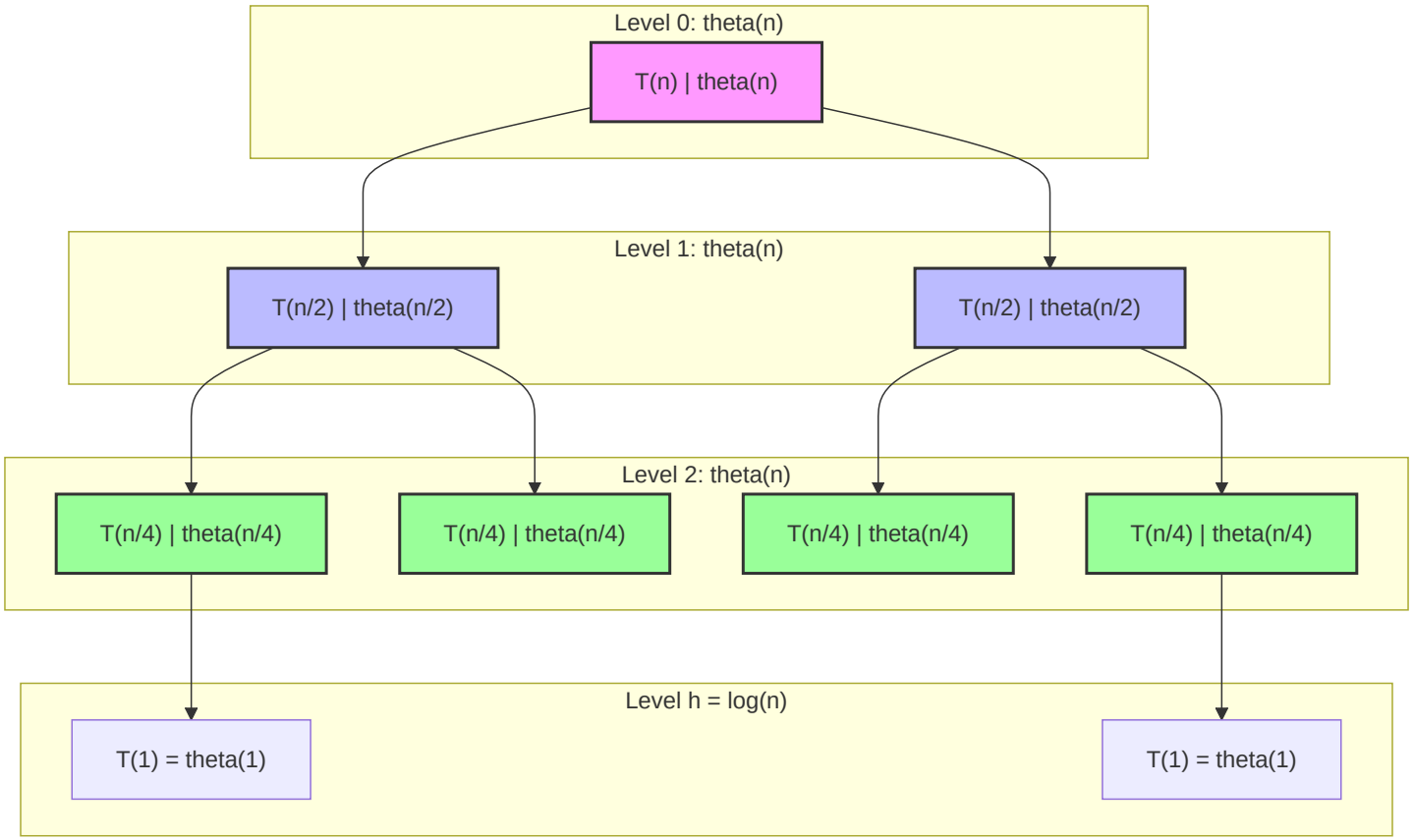
```
// MERGE-SORT(A, p, r)       // running time
if p < r then                // theta(1)
    q = floor((p + r) / 2)   // theta(1)
    MERGE-SORT(A, p, q)      // T(n/2)
    MERGE-SORT(A, q + 1, r)  // T(n/2)
    MERGE(A, p, q, r)        // theta(n)
```

Problem 3

Solve the recurrence of merge sort by using a recursion tree.

$$T(n) = \begin{cases} \theta(1) & \text{if } n = 1 \\ 2T(n/2) + \theta(n) & \text{if } n > 1 \end{cases}$$

Solution 3



Therefore, $T(n) = \theta(n \log n)$

Problem 4

What is the number of multiplications to evaluate the following cubic polynomial $f(x)$ when $x = 3$ if the Horner's rule is used?

$$f(x) = 4x^3 + 2x^2 + 5x + 2$$

Solution 4

1. Applying Horner's rule

$$f(x) = ((4x + 2)x + 5)x + 2$$

2. Count the number of multiplications
    i. $4x$
    ii. $(4x + 2)x$
    iii. $((4x + 2)x + 5)x$

3

Problem 5

Fill in the blank entries when the numbers are sorted by selection sort in non-decreasing order.

Solution 5

7	4	3	6	8	1	2
1	4	3	6	8	7	2
1	2	3	6	8	7	4
1	2	3	6	8	7	4
1	2	3	4	8	7	6

1	2	3	4	6	7	8

1	2	3	4	6	7	8

1	2	3	4	6	7	8