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1. We can sum $\sum_{k=1}^n k = \frac{n(n+1)}{2}$ inside text or use the displayed math like below:

$$\sum_{k=1}^n k = 1 + 2 + \cdots + n = \frac{n(n+1)}{2}$$

2. The recurrence (1) shows the worst-case running time $T(n)$ of mergesort:

$$T(n) = \begin{cases} c & \text{if } n = 1, \\ 2T(n/2) + cn & \text{if } n > 1. \end{cases} \quad (1)$$

Using the master theorem in Chapter 4, we can get $T(n) = \Theta(n \log n)$.

3. The recurrence (2) shows the worst-case running time $T(n)$ of binary search:

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

Using the master theorem in Chapter 4, we can get $T(n) = \Theta(\log n)$.

4. Browse <https://www.cs.dartmouth.edu/~thc/clrscode/clrscode3e.pdf> to learn how to use the `clrscode3e` package in LaTeX to typeset pseudocode.

INSERTION-SORT(A)

```

1  for  $j = 2$  to  $A.length$ 
2       $key = A[j]$ 
3      // Insert  $A[j]$  into the sorted sequence  $A[1..j-1]$ .
4       $i = j - 1$ 
5      while  $i > 0$  and  $A[i] > key$ 
6           $A[i+1] = A[i]$ 
7           $i = i - 1$ 
8       $A[i+1] = key$ 
```

5. If $f(n) = O(n^{\log_b a - \epsilon})$ for some constant $\epsilon > 0$, then $T(n) = \Theta(n^{\log_b a})$.