CIS 606 Homework 1 Fall 2020

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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:

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

   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:

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

   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($A$)
for $j$ = 2 to $A.length$
    $key = A[j]$
    // Insert $A[j]$ into the sorted sequence $A[1\,..\,j-1]$.
    $i = j - 1$
    while $i > 0$ and $A[i] > key$
        $A[i+1] = A[i]$
        $i = i - 1$
    $A[i+1] = key$
```

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