Chapter 1 Algorithm Analysis

Hints and Solutions

Reinforcement

R-1.1 Hint: Recall the method for graphing on a logarithmic scale.

R-1.2 Hint: Consider how it behaves on average.

Solution: The outer loop, for index j, makes n iterations. In $n/2$ of those iterations (for $j < n/2$), the next-inner loop, for index k, makes at least $n/2$ iterations. Finally, for $n/4$ of those iterations (for $k > 3n/4$), the inner-most loop, for index i, makes at least $n/4$ iterations. Thus, the MaxsubSlow algorithm uses at least $n(n/2)(n/4) = n^3/8$ steps, which is $\Omega(n^3)$.

R-1.3 Hint: Determine the place where these two functions cross.

R-1.4 Hint: Determine the place where the two functions cross.

R-1.5 Hint: Use the limit definition.

R-1.6 Hint: Note the similarity of "always" and "worst case."

R-1.7 Hint: When in doubt about two functions $f(n)$ and $g(n)$, consider $\log f(n)$ and $\log g(n)$ or $2^{f(n)}$ and $2^{g(n)}$.

Solution:

$$1/n, 2^{100}, \log\log n, \sqrt{\log n}, \log^2 n, n^{0.01}, \lceil\sqrt{n}\rceil, 3n^{0.5}, 2^{\log n}, 5n, n\log_4 n,$$

$$6n\log n, \lfloor 2n\log^2 n\rfloor, 4n^{3/2}, 4^{\log n}, n^2\log n, n^3, 2^n, 4^n, 2^{2^n}.$$

R-1.8 Hint: The numbers in the first row are quite large.

Solution: The numbers in the first row are quite large. The table below calculates it approximately in powers of 10. People might also choose to use powers of 2. Being close to the answer is enough for the big numbers (within a few factors of 10 from the answers shown).