1.5.4 Practical Complexities

- The time complexity of a program is generally some function of the instance characteristics. This function is very useful in determining how the time requirements vary as the instance characteristics change.
- The complexity function may also be used to compare two programs P and Q that perform the same task. Assume that program P has complexity $O(n)$ and program Q is of complexity $O(n^2)$. We can assert that program P is faster than program Q for "sufficiently large" n.
- To see the validity, observe that the actual computing time of P is bounded from above by cn for some constant c and for all $n, n \geq n_1$, while that of Q is bounded from below by dn^2 for some constant d and all $n, n \geq n_2$.

Since $cn \leq dn^2$ for $n \geq c/d$, program P is faster than program Q wherever $n \geq \max\{n_1, n_2, c/d\}$.