Solution 1: Complexity

1. $15,000 < n \log_2(n) < n^5 < 2^n < n!$

2. $10^5 < n^{0.5} < n \log_2(n) < n + n^2 + n^3$

3. The big-O notation:
   a. $O(n^{5/2})$
   b. $O(n)$
   c. $O(n^4)$
   d. $O(n^3)$

4. The iteration of variable $i$ is executed in $n$ times. Therefore, the run-time efficiency is $n$.

5. There are 3 nested loops, each loop is executed in $n$ times, so run-time efficiency is $n \times n \times n = n^3$.

6. Algorithm doIt is executed in $n$ times, so the run-time efficiency is $7n^2$.

7. The iteration of variable $i$ is executed in $n$ times while the iteration of variable $j$ is executed in $n-1$ times. Therefore, the run-time efficiency is $n \times (n-1) \times n^2 = n^4 - n^3 = O(n^4)$.

8. The algorithm doIt is executed inside a logarithmic loop which size is $n$, so the run time efficiency of the program is $\log_2(n) \times n^2 = O(n^2 \log_2 n)$.

9. $5 \times 10000^2 \times 10^{-9} = 500$ ms.

10. $3 \times 10000^3 \times 10^{-9} = 300$s.

11. $3 \times 8000 \times \log_2(8000) \times 10^{-9} \approx 3 \times 8000 \times 13 \times 10^{-9} \approx 312\mu s$. 