

Section 5.3 Homework

Exercises 1 and 2, let f be a function that describes the number of steps required to carry out a certain algorithm. The number of items to be processed is represented by n . For each function, describe what happens to the number of steps if the number of items is doubled.

1. (a) $f(n) = 1001$
Steps remain at 1001.
(b) $f(n) = 3n$
Number of steps double.
(c) $f(n) = 5n^2$
Number of steps quadruple.
(d) $f(n) = 2.5n^3$
Number of steps eight-fold.
2. (a) $f(n) = 1.4\log(n^2)$
Number of steps process by 1.4
(b) $f(n) = 2^n$
Number of steps is squared
(c) $f(n) = n\log(n)$
Number of steps doubles and adds $2n$ steps
(d) $f(n) = 100n^4$
Number of steps is multiplied by 16
4. Show that $h(n) = 1 + 2 + 3 + \dots + n$ is $O(n^2)$
 $\frac{n(n-1)}{2} = \frac{n^2-n}{2} = O(n^2)$
11. Determine which of the following are in the same Θ -class. A function may be in a class by itself.
 $\Theta = \{f_6, f_{10}, f_{11}\}, \{f_1\}, \{f_2\}, \{f_3\}, \{f_4\}, \{f_5\}, \{f_7\}, \{f_8\}, \{f_9\}, \{f_{12}\}$
12. Order the Θ classes in Exercise 11 from lowest to highest.
 $f_5, f_7, f_4, f_8, f_{10}, f_{11}, f_6, f_{12}, f_1, f_2, f_3, f_9$
13. Consider the functions $f_1, f_2, f_4, f_5, f_6, f_{10}, f_{11}$ in Exercise 11. Match each of the functions with its Θ class from the following list: $\Theta(1)$, $\Theta(n)$, $\Theta(n\log(n))$, $\Theta\log(n)$, $\Theta(n^2)$, $\Theta(\sqrt{n})$, $\Theta(2^n)$.
 $\Theta(1) = f_5$
 $\Theta(n) = f_6, f_{10}, f_{11}$
 $\Theta(n\log(n)) = f_1$

$$\Theta \log(n) = f_4$$

$$\Theta (n^2) = f_2$$

$$\Theta(\sqrt{n}), \Theta(2^n) = \text{null}$$