Homework Complexity 1

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RC11 – Skills Classes

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1 Exercise One

Solution: 9 - 6 - 1 - 5 - 4 - 2 - 3 - 8 – 7

2 Exercise Two

Solution:

1. n

$n = 60\ (10)^6$

2. n^2

$n^2 = 60\ (10)^6$

$n = \sqrt{60\ (10)^6}$

$n = 2000\sqrt{15}$

3. n^3

$n^3 = 60\ (10)^6$

$n = \sqrt[3]{60\ (10)^6}$

$n = 100\sqrt[3]{60}$

4. n!

$n! = 60\ (10)^6$

5. n ln(n)

$n \ln(n) = 60\ (10)^6$

$n = 10^6$

6. n log(n)

$n \log(n) = 60\ (10)^6$

$n = 10^6$

7. 2^n

$2^n = 60\ (10)^6$

$n = \frac{\ln(6(10)^6)}{\ln(2)}$

8. $n\sqrt{n}$

$n\sqrt{n} = 60\ (10)^6$

$n = 1.53261886 \cdot 105^5$

9. n^{100}

$n^{100} = 60\ (10)^6$

$n = \sqrt[100]{60\ (10)^6}$

10. 4^n

$4^n = 60\ (10)^6$

$n = \frac{\ln(6(10^7))}{\ln(4)}$

3 Exercise Three

3.1 A

Solution:

f(n) = $\sqrt{n}$, g(n) = ln(n^2);

$f(n) = O(g(n))$

2. f(n) = log(n), g(n) = ln(n);

$g(n) = O(f(n))$

3. f(n) = n, g(n) = log(n);

$f(n) = O(g(n))$

4. f(n) = n ln(n) + n, g(n) = ln(n);

$f(n) = O(g(n))$

5. f(n) = 10, g(n) = ln(10);

Both $g(n) = O(f(n))$ and $f(n) = O(g(n))$

6. f(n) = 2^n, g(n) = $10n^2$;

$g(n) = O(f(n))$

7. f(n) = 2^n, g(n) = 3^n

$f(n) = O(g(n))$

3.2 B

f(n) = 2 · log(n), g(n) = log(n)

$f(n) = O\big(g(n)\big)$:
f(n) ≤ 2 · log(n) ≤ 2 · log(n) = c · log(n) = c · g(n)
Take c = 2 and n = 1

$g(n) = O(f(n))$:
g(n) ≤ log(n) ≤ 2 · log(n) = c · log(n) = c · f(n)
Take c = 2 and n = 1

Both $g(n) = O(f(n))$ and $f(n) = O(g(n))$

6 Exercise Six

Solution:

$$T(n) = c_1 * (n-1) + c_4 * \sum_{i=1}^{n-1}(n-i) + c_2 * \sum_{i=1}^{n-1}(n-i) + c_3 * \sum_{i=1}^{n-1}(n-i) + c_5 * \sum_{i=1}^{n-1}(n-i)$$

7 Exercise Seven

Solution:

Algorithm 2:

$O(n)$

Algorithm 3:

$O(n^2)$

Algorithm 4:

$O(n^3)$

Algorithm 5:

$O(n^2)$

Algorithm 6:

$O(n^3)$