Algorithms and Data Structures
Homework3

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1 Problem 3.1

1.1 a

for f(n) = 9n and g(n) = $5n^3$

let us compute: $\lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim_{n\to\infty} \frac{9n}{5n^3} = \lim_{n\to\infty} \frac{9}{5n^2} = 0$

let us compute: $\lim_{n\to\infty} \frac{g(n)}{f(n)} = \lim_{n\to\infty} \frac{5n^3}{9n} = \lim_{n\to\infty} \frac{5n^2}{9} = \infty$

so we deduce:

f(n)$\in \omega(n), f(n) \in \Omega(n), f(n) \notin o(n), f(n) \notin O(n), f(n) \notin \Theta$
$g(n) \in (n), g(n) \notin \Omega(n), g(n) \in o(n), g(n) \in O(n), g(n) \notin \Theta$

1.2 b

for f(n) = $9n^{0.8} + 2n^{0.3} + 14log(n)$ and g(n) = $n^{0.5}$

let us compute: $\lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim_{n\to\infty} \frac{9n^{0.8}+2n^{0.3}+14log(n)}{n^{0.5}} = \infty$

let us compute: $\lim_{n\to\infty} \frac{g(n)}{f(n)} = \lim_{n\to\infty} \frac{n^{0.5}}{9n^{0.8}+2n^{0.3}+14log(n)} = 0$

so we deduce:

f(n)$\notin \omega(n), f(n) \notin \Omega(n), f(n) \in o(n), f(n) \in O(n), f(n) \notin \Theta$
$g(n) \in \omega(n), g(n) \in \Omega(n), g(n) \notin o(n), g(n) \notin O(n), g(n) \notin \Theta$

1.3 c

for f(n) = $n^2 \frac{}{log(n)}$ and g(n) = $n(n)$

let us compute: $\lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim_{n\to\infty} \frac{\frac{n^2}{log(n)}}{n \times log(n)} = \lim_{n\to\infty} \frac{n}{log^2(n)} = \infty$

let us compute: $\lim_{n\to\infty} \frac{g(n)}{f(n)} = \lim_{n\to\infty} \frac{log^2(n)}{n} = 0$

so we deduce:

f(n)$\notin \omega(n), f(n) \notin \Omega(n), f(n) \in o(n), f(n) \in O(n), f(n) \notin \Theta$
$g(n) \in \omega(n), g(n) \in \Omega(n), g(n) \notin o(n), g(n) \notin O(n), g(n) \notin \Theta$

1.4   d

for f(n) $= log^3(3n)$ and g(n) $= 9(n)$

let us compute: $\lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim_{n\to\infty} \frac{log^3(3n)}{9(n)} = \infty$

let us compute: $\lim_{n\to\infty} \frac{g(n)}{f(n)} = \lim_{n\to\infty} \frac{9(n)}{log^3(3n)} = 0$

so we deduce:

f(n)$\notin \omega(n), f(n) \notin \Omega(n), f(n) \in o(n), f(n) \in O(n), f(n) \notin \Theta$
$g(n) \in \omega(n), g(n) \in \Omega(n), g(n) \notin o(n), g(n) \notin O(n), g(n) \notin \Theta$

2   Problem 3.1

2.1   a

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for i = 0 to n-1
        key = i
        for j=i+1 to n
                j = key
        if i not key
                swap(i,key)
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2.2   b

2.3   c