Amine Chahi   HW0.3

P3.1:

a) $\lim\limits_{+\infty} \dfrac{f(m)}{g(m)} = \dfrac{9m}{\sqrt{m^3}} = 0$; $\lim\limits_{+\infty} \dfrac{\sqrt{m^3}}{9m} = +\infty$

Hence, $f \in O(g)$ & $f \in o(g)$

$g \in \Omega(f)$ & $g \in \omega(f)$

b) $\lim\limits_{+\infty} \dfrac{f(m)}{g(m)} = \dfrac{9m^2 + 2m^{0.3} + 14\log m}{\sqrt{m}} = +\infty$; $\lim\limits_{+\infty} \dfrac{g(m)}{f(m)} = \dfrac{\sqrt{m}}{9m^{0.5} + 2m^{0.3} + 14\log m} = 0$

$\Longrightarrow f \in \Omega(g) ; f \in \omega(g) ; g \in O(f) ; g \in o(f)$

c) $\lim\limits_{+\infty} \dfrac{f(m)}{g(m)} = \dfrac{m^2 \log m}{m \log m} = +\infty$ $\Big\}$ $f \in \Omega(g)$ $f \in \omega(g)$

$\lim\limits_{+\infty} \dfrac{g(m)}{f(m)} = \dfrac{m \log m}{m^2 \log m} = 0$ $\Big\{$ $g \in O(f)$ $g \in o(f)$

d) $\lim\limits_{+\infty} \dfrac{f(m)}{g(m)} = \dfrac{(\log(3m))^3}{9 \log m} = +\infty$; $\lim\limits_{+\infty} \dfrac{g(m)}{f(m)} = \dfrac{9 \log m}{(\log(3m))^3} = 0$

$\Longrightarrow f \in \Omega(g)$ $\Big($ $g \in O(f)$

$f \in \omega(g)$ $\Big($ $g \in o(f)$

P3.2:

a) ~~the~~ Check "Selectionsort.cpp"

b.) For the Algorithm to be correct, the loop invariant needs to pass 3 conditions:

* **Initialization**: initially the sorted array is empty with no element in it, hence we can say that it's sorted at that time. loop hold prior to 1st iteration

* **Maintenance**: Each iteration of the loop holds the invariant. left part of the sub-array till m element $A[0...m]$ is always sorted and the next element from $[m+1 ..... max]$ gets added to the left sub-array, hence, it maintains the loop invariant.

* **Termination**: Show Correctness. At the end of termination the left sub-array will be equal to the size of the loop. Hence no more elements to be sorted.

c.) For Case A: randomly shuffle an array with numbers from 1 to m and then we would move largest element to the beginning

For Case B: sorted sequence, with least swaps Write numbers from 1 to m into a file Check "Input.txt"