EL9343 Homework 1

(Due February 6th, 2022)

No late assignments accepted

All problem/exercise numbers are for the third edition of CLRS text book

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1.Prove the following properties of asymptotic notation:

(a) $n = \omega(\sqrt{n})$;

(b) If $f(n) = \Omega(g(n))$, and $h(n) = \Theta(g(n))$, then $f(n) = \Omega(h(n))$.

(c) $f(n) = O(g(n))$ *if and only if* $g(n) = \Omega(f(n))$ (*Transpose Symmetry* property)

2. Problem 3-2 in CLRS Text book.

3. You have 5 algorithms, A1 took $O(n)$ steps, A2 took $\Theta(n \log n)$ steps, and A3 took $\Omega(n)$ steps, A4 took $O(n^3)$ steps, A5 took $o(n^2)$ steps. You had been given the exact running time of each algorithm, but unfortunately you lost the record. In your messy desk you found the following formulas:

(a) $4(5^{2\log_5 n}) + 6n + 9527$

(b) $\sqrt[3]{3n!}$

(c) $(\frac{4^{\log_{15} n}}{6})^2 + 4n + 17$

(d) $3n\log_2 n + (\log_2 n)^2$

(e) $\log_2 \log_2 n + 6$

(f) $2^{3\log_2 n}$

(g) $(\log_2 n)^3 + \log_2 \log_2 n$

For each algorithm write down all the possible formulas that could be associated with it.

4. For the following algorithm: Show what is printed by the following algorithm when called with MAXIMUM(A, 1, 5) where A = [9, 12, 15, 5, 2]? Where the function PRINT simple prints its arguments in some appropriate manner.

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MAXIMUM(A, l, r)
1)  if (r − l == 0)
2)       return  A[r]
3)
4)  lmax = MAXIMUM(A, l, ⌊(l + r)/2⌋)
5)  rmax = MAXIMUM(A, ⌊(l + r)/2⌋ + 1, r)
6)  PRINT(rmax, lmax)
7)  if rmax < lmax
8)       return  lmax
9)  else
10)      return  rmax
```