

EL9343 Homework 1

(Due February 2nd, 2022)

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

1. Prove the *Transpose Symmetry* property, i.e. $f(n) = O(g(n))$ if and only if $g(n) = \Omega(f(n))$
2. Problem 3-1 in CLRS Text book.
3. Problem 3-2 in CLRS Text book.
4. 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) $3n \log_2 n + \log_2 \log_2 n$

(b) $3(2^{2 \log_2 n}) + 5n + 1234567$

(c) $\frac{2^{\log_4 n}}{3} + n + 9$

(d) $(\log_2 n)^2 + 5$

(e) $3n!$

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

(g) $2^{2 \log_2 n}$

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

5. For the following algorithm: Show what is printed by the following algorithm when called with $\text{MAXIMUM}(A, 1, 5)$ where $A = [10, 8, 6, 4, 2]$? Where the function PRINT simply prints its arguments in some appropriate manner.

```
MAXIMUM( $A, l, r$ )
1) if ( $r - l == 0$ )
2)   return  $A[r]$ 
3)
4)  $lmax = \text{MAXIMUM}(A, l, \lfloor (l + r)/2 \rfloor)$ 
5)  $rmax = \text{MAXIMUM}(A, \lfloor (l + r)/2 \rfloor + 1, r)$ 
6)  $\text{PRINT}(rmax, lmax)$ 
7) if  $rmax < lmax$ 
8)   return  $lmax$ 
9) else
10)  return  $rmax$ 
```