COM 501 Advanced Datastructures and Algorithms `Assignment-1`

Note: All assignments involve a team of size 5 or 6. Due: 19/Jan

1. Given an integer array, write an algorithm to find max and second max. Calculate its step count. Express the step count (time complexity) interms of $O, \Omega, \theta, o, \omega$.
2. Write a recursive algorithm to compute n^{th} fibonacci number. Calculate its step count. Also bound the same using asymptotic all notation.
3. Write an algorithm to list all ternary strings. Calculate its step count. Also bound the same using asymptotic all notation.
4. Say True or False with a precise justification.
   - $3\ 2^n - 4\ 3^n = \theta(2^n)$
   - $\frac{6}{n^2} + \frac{1}{n!} = \theta(1)$
5. For a problem P, there are six algorithms and their run-times are given below. Order them by Asymptotic Growth.
   (a) $A_1(n) = 5$
   (b) $A_2(n) = 2^{n \log n}$
   (c) $A_3(n) = n^{100}$
   (d) $A_4(n) = n^n$
   (e) $A_5(n) = n!$
   (f) $A_6(n) = (0.5)^{\log_2 n}$
6. In each of the following situations, indicate whether $f = O(g)$ or $f = \Omega(g)$ or both (in which case $f = \theta(g)$

	$f(n)$	$g(n)$
(a)	n-100	n-200
(b)	100n + log n	n + $(logn)^2$
(c)	log 2n	log 3n
(d)	$n^{1.01}$	$nlog^2n$
(e)	$n2^n$	3^n
(f)	$n!$	2^n