Algorithms Homework #1

Due: 2024/04/12

1. Prove by finding constants that satisfy the definition of order of magnitude, that
   a) $f = \Theta(g)$ if $f(n) = 3n^3 - 7n$ and $g(n) = n^3$

   b) $2n^2 - 7n = O(n^2)$

2. State whether each of the following is true or false:
   a) $7n^3 \lg n + 16n^3 = O(n^4)$

   b) $(\lg n)^{\lg n} = O(n^k)$, k is a constant

3. Ordering by asymptotic growth rates:
   $n!$ $(\lg n)!$ $\lg(n!)$ $\lg^* n$ $2^{\lg n}$ 2^n n^2
   Hint: Stirling's approximation

4. Using expanding method to solve the recurrence:
   $T(n) = T(n/2) + \Theta(n)$ with $T(n) = c$, if $n = 1$