CSE 551 Foundation of Algorithms
Quiz 1, Fall 2022
Closed Books, Closed Notes
Time: 40 minutes
Each question carries 30 pts.

Question 1 [6×5 **points**]

(i) Define the terms big-O, big-Ω and big-Θ notations.

(ii) Let α and β be real numbers such that $0 < \alpha < \beta$.

(a) Is n^α in $O(n^\beta)$?

(b) Is n^β in $O(n^\alpha)$?

For (a) and (b), justify your answer.

(iii) Show that, if c is a positive real number, then $g(n) = 1 + c + c^2 + \cdots + c^n$ is:

- $\Theta(1)$ if $c < 1$.
- $\Theta(n)$ if $c = 1$.
- $\Theta(c^n)$ if $c > 1$.

Question 2 [3×10 **points**]

Suppose you are choosing between the following three algorithms:

- Algorithm A solves problems by dividing them into five subproblems of half the size, recursively solving each subproblem, and them combining the solutions in linear time.
- Algorithm B solves problems of size n by recursively solving two subproblems of size $n - 1$ and then combining the solutions in constant time.
- Algorithm C solves problems of size n by dividing them into nine subproblems of size $n/3$, recursively solving each subproblem, and then combining the solutions in $O(n^2)$ time.

What are the running times of each of these algorithms (in big-O notation)? Show all your calculations as to how you arrived at that conclusion.