

Only 1 choice is correct for each question and there are at least 5 choices for each question (Exam will be a test)

- 1: What is the asymptotic upper bound run time of X sort? (5pts)
- 2: Which order of the asymptotic growth rates shown below is correct? (5pts)
- 3: For the functions, n^k and c^n which one of the below asymptotic relationships between these functions is correct? (5pts)
- 4: For the functions below, which one of the asymptotic relationship is correct? (5pts)

Four cases of the Master Method are shown below.

The Master Method: Case 1	The Master Method: Case 2 (simple version)
<div>□ Recurrence: $T(n) = aT(n/b) + f(n)$</div> <div> Case 1: $\frac{n^{\log_b a}}{f(n)} = \Omega(n^\epsilon)$ for some constant $\epsilon > 0$ </div> <div> <i>i.e., $f(n)$ grows polynomially slower than $n^{\log_b a}$ (by an n^ϵ factor).</i> </div> <div> Solution: $T(n) = \Theta(n^{\log_b a})$ </div>	<div>□ Recurrence: $T(n) = aT(n/b) + f(n)$</div> <div> Case 2: $\frac{f(n)}{n^{\log_b a}} = \Theta(1)$ </div> <div> <i>i.e., $f(n)$ and $n^{\log_b a}$ grow at similar rates</i> </div> <div> Solution: $T(n) = \Theta(n^{\log_b a} \lg n)$ </div>

The Master Method: Case 2 (general version)	The Master Method: Case 3
<div>□ Recurrence: $T(n) = aT(n/b) + f(n)$</div> <div> Case 2: $\frac{f(n)}{n^{\log_b a}} = \Theta(\lg^k n)$ for some constant $k \geq 0$ </div> <div> Solution: $T(n) = \Theta(n^{\log_b a} \lg^{k+1} n)$ </div>	<div> Case 3: $\frac{f(n)}{n^{\log_b a}} = \Omega(n^\epsilon)$ for some constant $\epsilon > 0$ </div> <div> <i>i.e., $f(n)$ grows polynomially faster than $n^{\log_b a}$ (by an n^ϵ factor).</i> </div> <div> <i>and the following regularity condition holds:</i> $af(n/b) \leq cf(n)$ for some constant $c < 1$ </div> <div> Solution: $T(n) = \Theta(f(n))$ </div>

Please solve the following four questions according to the Master Method

- 5: What is the asymptotic notation of this function X ? (5pts)
- 6: What is the asymptotic notation of this function X ? (5pts)
- 7: What is the asymptotic notation of this function X ? (5pts)
- 8: What is the asymptotic notation of this function X ? (5pts)

- 9: What would be the running time of below pseudo code shown algorithm? (5pts)
- 10: How X algorithm works at each step (something similar to this) (5pts)
- 11: Why X algorithms are faster than Y algorithms? (5pts)
- 12: Which one of the attributes below is not a characteristic of recursive algorithms? (10pts)
- 13: Which one of the attributes below is not a characteristic of dynamic programming? (10pts)
- 14: Which one of the below components is not one of the component of greedy algorithms? (5pts)
- 15: How many vertices and edges there are in the graph below? (5pts)
- 16: Describe the below directed graph as Vertices and Edges list (5pts)
17. Which one of the below average run time (θ) speed order of the sorting algorithms is correct? (5pts) ($A > B$ means A is faster than B)
18. Which one of the below algorithm run times is not solvable in polynomial-time (which one is NP) (5 pts)