CS344: Design and Analysis of Computer Algorithms

Homework 3

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2.4) 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 then 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.

Answer:

- $T(n) = 5 * T(n/2) + cn$.
   Applying master theorem a = 2, b = 5, f(n) = c n, degree(f(n)) = 1
   Since $\log_2 5 > 1, T(n) = O(n^{\log_a b}) = O(n^{\log_2 5})$

- $T(n) = 2T(n-1) + c. \therefore T(n) = O(2^n)$

- $T(n) = 9T(\frac{n}{3}) + cn^2$.
   Applying master theorem a = 3, b = 9, $f(n) = cn^2$, degree(f(n)) = 2
   Since $\log_3 9 = 2, T(n) = O(n^2 \log n)$

Time complexity of the third algorithm is the best. $\therefore$ choose algorithm C

2.5) Solve the following recurrence relations and give a Θ bound for each of them.
 Answer:

2.14) ?
 Answer:

2.25) ?
 Answer:

2.28) ?
 Answer:

3.5) ?
 Answer:

3.31) ?
 Answer:

3.43) ?
 Answer: