1 Recursion trees

Consider the recurrence relation $T(n) = 5T(\frac{n}{4}) + 2n$

What is the number of problems in level 4? (We use the convention that the root problem of size n is on level 0.)

- O 1024
- O 125
- 625
- O 4096

Correct

What is the size of each problem in level 5?

- O $\frac{n}{512}$
- O $\frac{n}{3125}$
- O $\frac{n}{625}$

Correct

What is the total contribution in level *i*?

- O $(\frac{4}{5})^i \times 2n$
- \bullet $(\frac{5}{4})^i \times 2n$
- O $(\frac{4}{5})^{(i-1)} \times 2n$
- O $(\frac{5}{4})^{(i-1)} \times 2n$

Correct

Which one is true for T(n)?

- O $T(n) = \Theta(n^{\log_4 5})$
- O $T(n) = O(n^2)$
- O $T(n) = \Omega(n)$
- All of the above!

Correct

2 The master theorem

Remember that the master theorem applies to recurrences of the form

$$T(n) = a \cdot T\left(\frac{n}{b}\right) + O(n^d).$$

Consider the recurrence relation $T(n) = 3T(\frac{n}{81}) + 10\sqrt{\sqrt{n}}$. What are the values of the parameters a, b, d? Write fractional values in the form of 0.x or 0.xx.

a =

3

Correct

b =

d =

81

Correct

0.25

Which one is true for T(n)?

- $O T(n) = \Omega(n)$
- O $T(n) = \Theta(n^2)$
- $T(n) = \Omega(\log(n)\sqrt{\sqrt{n}})$

Correct

3 The substitution method

Consider the recurrence relation $T(n) = 2T(n/2) + 3T(n/3) + n^2$. Which one is the smallest valid bound for T(n)?

- O T(n) = O(n)
- $T(n) = O(n^2)$
- O $T(n) = O(n^3)$

Correct

Which one would be the best guess to substitute T(n) with if we wanted to prove the above bound? (Which bound would be provable by induction as in the substitution method and is the tightest such bound.)

- O $T(n) \leq 12n$
- O $T(n) \le n^3$
- $T(n) \le 6n^2$
- O $T(n) \le 2n^2$

Correct