

Practice questions

Q1.

$$T(n) = 5T(n-1) - 6T(n-2), \quad T(0) = 2, \quad T(1) = 5$$

- Solve this recurrence and find $T(n)$.

Q2.

You have 2 eggs and a building with 100 floors (*or n floors*). Find the minimum number of attempts (as complexity in terms of the number of floors) required in the worst case to determine the highest floor from which you can drop an egg without it breaking. Can you do better than $O(n)$?

Q3.

What is the minimum number of **swaps** you need to make to fully sort an array of size **n** ? (Comparison operations are free) Give your answer as an absolute value in terms of n , not as complexity.

Q4.

1. Compare and Recur.

- (a) (5 points) Let S be a set of n arbitrary but distinct numbers. Give an algorithm to find both the maximum element *and* the minimum element in S . (You may assume that n is even.) The algorithm must use at most $\frac{3}{2}n - 2$ comparisons.

Q5.

- (b) (5 points) Solve the following recurrence by constructing the recursion tree, giving your answer in $\Theta()$ notation, assuming the base case that $T(x) = 1$ for $x \leq 2$.

$$T(n) = \sqrt{n}T(\sqrt{n}) + n.$$

Q6.

Show that

$$\lg(n!) = \theta(n \log n)$$