

3.)

Best-case for quicksort: chooses median for the pivot, splitting the list in half, such that:

$$2T\left(\frac{n}{2}\right) + \Theta(n) = \Theta(n \log n)$$

Worst-case for quicksort: chooses the last or first element in a list as the pivot, such that:

$$T(n-1) + T(1) + \Theta(n) = \Theta(n^2)$$

Runtime for our recurrence relation, choosing  $\left(\frac{2}{3}\right)^{th}$  largest element in a list, such that:

$$T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + \Theta(n) = \Theta(n \log n)$$

Note the runtime for our recurrence and the best-case for quicksort are asymptotically equal to one another.

Ordering the functions from smallest to greatest:

$$(\Theta(n \log n)), (\Theta(n \log n)) = (\text{Best-case, our recurrence relation})$$

$$\Theta(n^2) = \text{worst-case}$$