Algorithm analysis

Slowest:

Total time: ≈17 hours 19 minutes

Big-oh: $O(n^3)$

$$\frac{T_1}{T_2} = \frac{T_{100000}}{T_{50000}} = \frac{5.6 \times 10^7 \text{ s}}{6.51 \times 10^6 \text{ s}} \Rightarrow \frac{56}{6.5} \Rightarrow \approx 9 = \left(\frac{100000}{50000}\right)^k \Rightarrow$$

$$\Rightarrow 1 = (2)^k \Rightarrow \frac{\log(9)}{\log(2)} = k = 3.16 \approx 3 \Rightarrow \boxed{O(n^3)}$$

Fast:

Total time: 2.77 Seconds

Big-oh: $O(n^2)$

$$\frac{T_1}{T_2} = \frac{T_{100000}}{T_{50000}} = \frac{2093}{554} \Rightarrow 3.78 \approx 4 = \left(\frac{100000}{50000}\right)^k \Rightarrow$$

$$\Rightarrow \frac{\log(4)}{\log(2)} = k = \boxed{2} \Rightarrow \boxed{O(n^2)}$$

Fastest:

Total time: .0006 Seconds

Big-oh: $O(n)$

$$\frac{T_1}{T_2} = \frac{T_{100000}}{T_{50000}} = \frac{1}{1} = 1 = (2)^k \Rightarrow \frac{\log(1)}{\log(2)} = 0. \leftarrow \text{must be less than } O(n)$$

Added $T_{1,000,000}$; $T_{10,000,000}$ to get results

$$\frac{T_1}{T_2} = \frac{T_{10,000,000}}{T_{1,000,000}} = \frac{38}{4} \approx 9.5 = (10)^k \Rightarrow \frac{\log(9.5)}{\log(10)} = k$$

$\boxed{k \approx 1}$ $\boxed{O(n)}$