12. Write a function to determine (in logarithmic time) the range of elements in a strictly increasing sequence $a_0, a_1, a_2, \ldots, a_{n-1}$ that have $a_i = i$.

18. Use the substitution method to show $\sum_{i=1}^{n} i = \Theta(n^2)$.

19. Show $T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$ is in $\Theta(\sqrt{n \log n})$ using the substitution and recursion tree methods.

20. Show $T(n) = 3T\left(\frac{n}{3}\right) + n^2$ is in $\Theta(n^2)$ using the substitution and recursion tree methods.

21. Show $T(n) = 2T\left(\frac{n}{4}\right) + 1$ is in $\Theta(\sqrt{n})$ using the substitution and recursion tree methods.