Exercise 4

Question 1: Derive the formula for worst-case complexity.

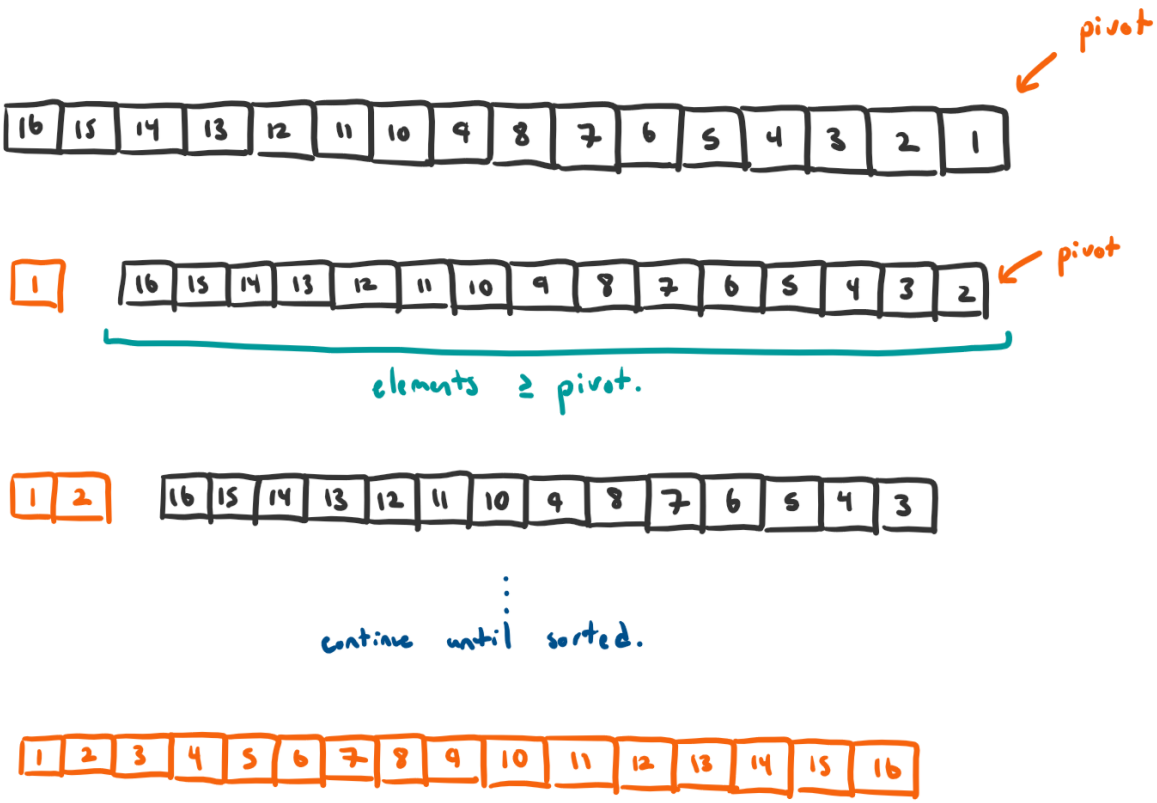
Suppose that n represents the number of elements in the array. The equation for the worst-case complexity is $\frac{n(n+1)}{2} - 1$.

We know that the worst case for a quicksort is when the first element or the last element is chosen as the pivot point. Since each partition is invoked recursively from the last, it is really the sum of n+(n-1)+(n-2)+(n-3)+...+ 2.

We then subtract 1 because in quicksort the summation starts at 2, not 1.

By simplifying we get $\frac{n(n+1)}{2} - 1$.

Question 2: Come up with a vector of 16 elements which incurs worst-case complexity. Manually show the workings of the algorithm until the vector is sorted.



Question 4: Plot the results, together with appropriate interpolating functions and discuss your results: do they match your complexity analysis?

Yes, the results obtained match our complexity analysis. We expected the graph to be quadratic since the equation that we derived is also quadratic. The shape of the graph is clearly quadratic and thus matches our complexity analysis.