Problem 1. (1 point) Illustrate the operation of randomized quicksort on the array:
\[ A = (19, 2, 11, 14, 7, 17, 4, 3, 5, 15) \]
By showing the values in array \( A \) after each call to \textit{partition}.

Problem 2 (CLRS 7.2-5). (2 points) Suppose that the splits at every level of quicksort are in
the proportion \( 1 - \alpha \) to \( \alpha \), where \( 0 < \alpha \leq 1/2 \) is a constant. Show that the minimum depth of a
leaf in the recursion tree is approximately \( -\log n / \log \alpha \) and the maximum depth is approximately
\( -\log n / \log(1 - \alpha) \). (Don't worry about integer round-off.)

Problem 3 (CLRS 7.2-6). (3 points) Argue that for any constant \( 0 < \alpha \leq 1/2 \), the probability is
approximately \( 1 - 2\alpha \) that on a random input array, \textit{partition} produces a split more balanced
than \( 1 - \alpha \) to \( \alpha \).

Problem 4 (CLRS 7.4-3). (2 points) Show that the expression \( q^2 + (n - q - 1)^2 \) achieves a
maximum over \( q = 0, 1, ..., n - 1 \) when \( q = 0 \) or \( q = n - 1 \).

Problem 5 (CLRS 7.4-2). (3 points) Show that quicksort's best-case running time is \( \Omega(n \log n) \).