1. Trace the execution of partition using the array \( \{40, 70, 10, 80, 60, 20, 30, 50\} \) as input.

2. In quicksort, instead of choosing the last (or first) element as pivot, we can select the element in the middle of the sub-array. Would this produce good results when the array is already sorted? Show a permutation of the array \( \{1, 2, 3, 4, 5, 6, 7\} \) that would result in the worst possible running time using this pivot-selection strategy.

3. In randomized quicksort we select a random element as the pivot to avoid quadratic running times for particular inputs. An alternative is to choose three elements at random and use the median of the three elements as pivot. Write recurrences describing worst-case running times of these two algorithms, assuming all entries in the array are different.