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Excercise 3

Task 1
Wahr oder falsch? Begründen Sie ihre Antwort.

(a) For each n, Quicksort uses $O(n^2)$ comparisons for each array with n elements.

(b) For each n, Quicksort uses $\Theta(n^2)$ comparisons for each array with n elements.

(c) For each n, there is an array with n elements, such that Quicksort uses $\Omega(n^2)$ comparisons.

(d) For each n, there is an array with n elements, such that Quicksort uses $\Theta(n \cdot \log n)$ comparisons.

(e) For each n, there is an array with n elements, such that Quicksort uses $O(n)$ comparisons.

(f) For each n, Quicksort uses $\Theta(n \cdot \log n)$ comparisons on average for arrays with n elements.

Task 2
The lower bound for sorting algorithms assumes that all elements of the array are different. Give a new lower bound without that limitation.

Hint: Ordered Bell numbers.

Task 3
Sort the array

$$[7, 3, 8, 1, 5, 2, 4, 6]$$

using Standard-Heapsort. How many comparisons do you need?