



Introduction to Computing for the Social Sciences
Exercise Sheet for Session 09

Prof. Dr. David Garcia

Exercise 1: Algorithmic complexity

- a) What is the time complexity of repeated minimum search in O-notation? Explain how you reach your answer from the pseudocode of the algorithm
- b) Using O-notation, describe the time complexity of Bellman-Ford. Explain your answer based on its pseudocode.

Exercise 2: A complexity example

- a) Write the pseudocode of an algorithm that finds the k-th smallest element in any list by doing k searches for the smallest element.
- b) Assuming that $k=1$ and N is the length of the list, is the runtime of the above algorithm $O(N^2)$? Explain your answer formally.
- c) Consider a situation in which the possible values of k tend to grow with $N^{0.5}$, where N is the length of the list. Explain in your own words how you would modify your pseudocode to make it more time-efficient and explain your rationale for the improvement.

Exercise 3: O-notation

- a) We have an algorithm with running time that grows with the size of the problem n following the function $f(n) = 200 * n + 1000000$. Is this function in $O(n^3)$? Explain your answer formally
- b) We have an algorithm with running time that grows with the size of the problem n following the function $f(n) = e^n$. Is this function in $O(n^n)$? Explain your answer formally