



Exercise IX, Sublinear Algorithms for Big Data Analysis 2024-2025

These exercises are for your own benefit. Feel free to collaborate and share your answers with other students, and solve as many problems as you can. Problems marked (\*) are more difficult, but also more rewarding. These problems have been taken from various sources on the Internet, too numerous to cite individually.

- 1 Prove that any single pass streaming algorithm that tests whether the input graph is connected (and is correct with probability at least  $9/10$ ) requires  $\Omega(n)$  bits of space.
- 2 Prove that any single pass streaming algorithm that tests whether the input graph contains a perfect matching (and is correct with probability at least  $9/10$ ) requires  $\Omega(n^2)$  bits of space.